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Introduction

After 30 years in Radiation Physics, I retired and decided it was the time to try to understand quantum theory, but this led to questions about the nature of reality. And then you people asked for a philosophical paper. So I decided to combine the two quests. This report is a snapshot of a work in progress.

The source of the information I have condensed and will comment on comes mostly from the material presented in 3 books I recently acquired. They are:

THE CONSEQUENCE OF IDEAS by R. C. Spraul, 1985.
QUANTUM REALITY: BEYOND THE NEW PHYSICS by Nick Hebert, 1985
THE NON-LOCAL UNIVERSE: THE NEW PHYSICS AND MATTERS OF THE MIND
by R. Nadeau and M. Kafatos, 1999

The subject is Reality & Related Concepts. Over the years, a few people have ask what we mean by Reality. Whatever it is, most of us think of it as the physical universe we live within, but to the extent that we don't know what, if anything, supports this idea, there has always been some confusion. This confusion has, in the last 80 years, been increased by the bizarre claims about the nature of reality being generated by scientists working on Quantum Theory. Arthur Eddington is reported to have said, "I am afraid of this word Reality." In spite of this confusion, I am resolved to press ahead and present this very brief history.

THE PRE SOCRATIC ERA 6^{TH} & 5^{TH} CENTURIES BC

Western Philosophy seems to have started in the ancient Aegean region in about the 6^{th} Century BC. At that time, the activity we now call science was Natural Philosophy, and they already had concepts like:

1. Reality – The assumed fundamental stuff out of which everything else is made. This was a very limited concept at this time.
2. Substance – The corporeal touchable stuff of the physical world.
3. The metaphysical world – That non-corporeal part of the experienced world that could be experienced by creatures with awareness. Spirits, Gods and ideas were in the metaphysical world.
4. Philosophy , The activity that defines and explains events of everyday life.
5. Knowledge –The collection of explanations and facts deemed to be true.
6. Truth – Knowledge about which no doubt existed.
7. The concept of causality.
8. The concept of space & lapsed time. Time passage was experienced but could not be touched. It was not classified as metaphysical because it acted on all substances and things, independent of any awareness.

This list points out that one of the most fundamental assumptions of our Western intellectual tradition was already in place at this very early time. That is the conviction that there is a fundamental division between the realm of matter and the realm of the mind (the meta-world.) This is an early and well established dualism. The dualism concept, in one form of another is increasingly with us.

In the two centuries after 600 BC, several people made the historical record with new ideas.

There was Thales , about 600 BC, who decided that Reality, the fundamental stuff, was water.

Then Pythagoras, about 530 BC, claimed that Reality, the fundamental stuff was second class. Pure ideas were the most important considerations. Metaphysics was his king.

Later, Heraclitus, about 510 BC, said corporeal reality was not stable because everything was in flux or changing. The change was orchestrated by outside universal law. He said Reality was Fire. He expanded the reality concept to include everything corporeal.

Democritus, about 500 BC, said, " ---, Nothing but Atoms and the Void."

Parmenides, about 490 BC, apparently needing stability, said Reality is divided between a static non-corporeal 'Ultimate Reality' and the corporeal reality that is changeable. This again expanded the scope of the reality concept.

Anaxagoras, about 475 BC, put Reality back together again by claiming it encompasses both the corporeal and the non-corporeal. It was one thing with two parts.

Then Zeno, about 460 BC, included space & time in the Ultimate Reality but claimed that corporeal experiences were not part of reality. This limited the reality concept to a kind of expanded metaphysics which covered what he considered non-corporeal.

Empedocles, about 460 BC, said Reality, the fundamental stuff, was composed of numerous immutable eternal particles. He introduced the idea that motion & change were caused by natural forces, but admitted that the mechanisms were not understood.

And then Protogoras , about 450 BC, upset things when he claimed that the broader Reality was an idea of the mind and its ascribed features were influenced by our preference. Man was the measure of all things. Now Reality was a meta-physical concept.

After 404 BC, skepticism led to a decline in critical thinking.

THE SOCRATIC ERA 5^{th} & 4^{th} CENTURIES BC

In the following 2 centuries, only two people made statements about reality that have so far come to my attention.

Plato, about 390 BC, inquired into the nature of Reality. He decided that Reality was a part of the world and, following Parmenides, had 2 parts. The primary reality was the world of "Ideas and True Knowledge," which could not be derived from experience. This knowledge was innate in the Soul which was in the mind. The secondary reality was the experienced world and the things in it. Material objects were poor copies of their ideal perfect forms. These imperfect material objects were considered "receptacles" because they contained all the properties assigned to them. Reality was now both meta-physical and physical.

And then, there was Aristotle, about 350 BC, who applied logic to the investigation of Reality, because logic would be valid for all reality. He claimed that the pure essence of a thing, the "Ideal Form", existed within the thing so that all things are a combination of Form & Matter. The Form contained the principle that governs matter becoming what it becomes. These Forms exist as themselves in things. He also claimed that all that was real could be understood.

The new ideas coming from these people include:

1. The idea that knowledge of the Ultimate or Primary Reality was innate in the Soul. Plato 428>508 BC.
2. The idea that the seat of the soul was the mind. Plato 428>508 BC.
3. The idea that all material things were poor copies of their perfect forms which existed in each thing. Plato 428>508 BC.
4. The idea that the imperfect material things were receptacles for all the properties assigned to them. Plato 428>508 BC.
5. The idea that the Perfect Forms are real even though non-corporeal. Aristotle
6. The idea that real things could be understood. Aristotle
7. The idea that Reality encompassed both the physical and the meta-physical. Plato

THE EARLY CHRISTIAN ERA

After Aristotle there was another wave of skepticism and the knowledge of ancient Greece fell out of use in the early Christian world.

Then Ptolemy, about 110 AD, proposed a structure of concentric crystalline spheres centered on the earth to carry the observed things above the immediate sky.

Augustine, about 400 AD, decided that Reality, the known universe, was the creation of "The" preexisting God but the creations themselves were mutable. Access to knowledge was through both divine revelation and investigation. The early Church was promoting the investigational activity of natural philosophy. Augustine said the drive to investigate required faith that the questions have answers and that the answers found will be understandable. This is similar to Aristotle claiming that real things could be understood.

About 800 years later, Aquinas, agreed with Augustine that "The God" created reality. He believed that Theology and Philosophy were both essential to the search for truth. He agreed with Augustine's concept that all knowledge came from God's Revelations. These revelations were not only in the Bible, but were also to be seen in nature throughout the cosmos. Thus natural philosophy was separate from Theology but was still an acceptable path to God's Truth.

The new ideas of the Early Christian Era related to this discussion are:

1. The idea that the things observed in the sky were organized and moved according to some plan. Ptolemy 110 AD
2. The idea that Reality was the creation of the preexisting God but his creations were mutable. . Augustine, 400 AD
3. The idea that the act of investigation requires faith that some answers are available and understandable. Augustine, 400 AD
4. The idea that investigating nature was a path to God. Aquinas, 1250 AD

THE AGE OF REASON 16th Century.

At the dawn of the 16th century, the age of reason, the New Skeptics promoted the idea of looking at both sides of every issue in order to suspend Philosophical judgments. They argued against

knowledge of God, because our senses could only detect the appearance of things, not the real thing. Reality was not available to the senses.

The Copernican Revolution caused a major philosophical upset. The Aristotelian World View, aided by Ptolemy had the earth at the center of the universe. Copernicus, about 1500, studied and liked the Ptolemaic System, but better methods of observation had began to show serious errors. Copernicus put the Sun at the center and upset the accepted world view. Some think he did this because the fundamental stuff was fire (after Heraclitus), and this fundamental stuff should be at the center of things, and the experienced sun had some properties like fire.

Because he was committed to the idea that God would only allow celestial bodies to move in perfect forms, he put all the planets on circular orbits. Thus, his model did not work much better than Ptolemy's. Christian organizations were against this idea which started the rift between religion and natural philosophy. Despite Church objections, other natural philosophers continued to use and improve the Sun centered model. Kepler, working on the problem of the apparent retrograde motion of Mars, found that if the orbit was an ellipse, the retrograde motion problem vanished. By assuming all planet orbits were ellipses, he made the Copernican model work much better. This correction by Kepler started to chip away at Plato's concept of perfect forms.

Then 100 years later, came Descartes, a Mathematician. Mathematics was an extension of logic and was popular because it was seen as an absolute field that was independent of the senses and could not be negated by the Skeptics. The products of logic and math had a certainty that was much desired in what he thought was an age of confusion.

His program of self criticism was designed to discover Fundamental Truths which could be used to test other ideas. This rigorous system of doubt rejected as false anything about which he could imagine even the slightest doubt. When he applied this, he discovered that everything in his world could be false. His search for a statement that he knew was true found only, "I think, therefore I am."

Based on his certitude about himself, he deduced the existence of God. He was convinced that a perfect God would not be a deceiver, so his thoughts about experiencing the world with the senses were real.

MORE ON THE AGE OF REASON 17th Century.

Rationalism dominated the 17th century. The problem of the relationship between thought and action created a major theological problem in the question of how God is related to the world with respect to causality. The successes of natural philosophy had created the idea that nature was a machine that ran independently, according to established Laws. Nature seems to have become the detectable part of Reality.

Spinoza, about 1660, in his "Substance Philosophy", put God back into nature but identified two aspects of nature. God was a special "self-existent substance" in nature which had an infinite number of manifestations of substance that the mind could perceive. All natural things were expressions of God

manifesting himself in the world. All thoughts and actions of man were expressions of God's attributes in the world. Because these expressions, being God's, were fixed forever and all actions happen by necessity, free will was eliminated.

Leibniz, about 1690, while looking for an explanation of why the universe appears to be designed to display order rather than chaos, applied mathematical concepts to considerations of reality. His Pre-established Harmony Philosophy, was a complex cosmology based on the "monad," an elemental unit of Reality. Monads, though existing independently, could act together in Harmony. Since only an independent outside authority could establish these harmonies, God was required both for the design and the continuing authority. Because of his "best of all possible Worlds" philosophy, he is thought to be the model for Voltaire's Dr. Pangloss.

Then Locke challenged Rationalism at the point of its insistence on "innate ideas in the mind of man" with his "The starting mind is a Blank Slate" idea.

In 1690, his essay on Human Understanding sought to discover how knowledge is acquired so he could understand "What we can Know." He claimed that all knowledge was learned from experience and begins with simple ideas which come from two sources. The first and greatest source was Sensations. Sensations were from the 5 senses, which perceived an "Empirical or apparent Reality." The second source, Reflection, involved awareness, thinking, doubting, reasoning and other activities of the mind, that produce ideas. These ideas included the ideas of space & time.

He tackled the ancient idea of Perfect Forms by claiming that so called Universal Forms were not real , only individual things had a real existence. He agreed with the Metaphysical Skeptics that the mind did create the idea of universals, but claimed we could not know the real essence of things.

He defined Truth as that which corresponds to Reality, but admitted to the problem of how to know Reality. The bridge from his mind to the outside world was through the five senses, but he doubted their ability to give him good data. He tackled this problem by defining Primary and Secondary Qualities which we encounter by perceiving the qualities of objects. Primary Qualities were inherent to the object and when perceived, were the reality of the object, but not the essence, which was not real. His primary qualities were solidity, extension, figure, motion or rest, and number.

Secondary Qualities, not inherent in the object, were those sensations that the object has the power to create in us. His list included color, sound, taste and odor.

He found it necessary to assume the basic reliability of sense perception, so that the perceptions were not just the projections of the mind. Only substantive Realities (I think this means real things?) could produce perceptions.

Huygens, about 1650, was able to explain the target-like image, now called a diffraction pattern, produced by shining a light beam through a very small hole by assuming that light was a wave. This started the idea that light was a wave. This idea will be very important later.

Natural Philosophers were interested in how the world is put together – out of what sort of basic objects, interacting via what sorts of basic forces. By the end of the 17th century, Galileo, Newton and other natural philosophers discovered that an enormous body of physical facts could be encompassed within a few mathematical formulas. With 3 mathematical laws, Newton could explain all motion in heaven and on earth. The applicability of mathematics, a product of the mind, to the real world was a source of puzzlement to scientists and philosophers, but the success of these early mathematical models led to the assumption that there must be a one-to-one correspondence between every element of physical reality involved, and the elements of the physical theory or mathematical model being used to explain the phenomena.

1. The idea that light was a wave. Huygens
2. The idea that all thoughts and actions of man were expressions of Gods attributes in the world. Spinoza
3. The idea that expressions of God were fixed forever, and all actions happen by necessity. Spinoza
4. The idea of the "monad," an elemental unit of Reality. Monads, though existing independently, could act together to create real things. Leibniz
5. The idea that all knowledge was learned from experience. Locke
6. the idea that the ancient concept of Universals or Perfect Forms could be false. Locke
7. The idea that Truth was that which corresponds to reality. Locke
8. The idea that perceived qualities of objects were of two kinds. Locke

THE 18TH CENTURY ENLIGHTENMENT

The 18th Century Enlightenment was a response to the Skepticism of the 17th Century. The Analytic Method of knowing, which is the heart of the Scientific Method, was born. This method, like Aristotle's, seeks the logic of the facts, by gathering facts inductively and empirically and searching for the pattern of rules operating within these facts.

Berkeley's famous statement, about 1710, "To be, is to be observed" was also the source of much humor. Or, as Bishop Knox wrote:

> Dear sir. I think it exceedingly odd, that the tree in the Quad,
> continues to be when there is no one about in the Quad.

Berkeley distinguished between activities of the mind and impressions received by the mind. Activity of the mind, by willful fabrication, produces thoughts and ideas. Passively received sense impressions do not require volition. He argued that, whatever may or may not exist outside of us, we can know only what sensory information we remember and what we conclude from reflection on this data and the ideas we have created. Thus all we can ever know is ideas. Like Protogoras, Reality is in the mind.

He rejected Locke's primary and secondary qualities because to him all qualities were secondary to being perceived. He does not deny that an objective reality can exist, but insists that "it only exists while being perceived."

Berkley also acknowledges that the regularity in the sequences of repeated perceptions of a specific remembered object leads one to assume that there is an ongoing material substratum to external experienced reality, and the ancient concept of causality makes us assume that there are physical mechanistic causes involved in the interactions of physical things.

At this time there was some attention given to the mysterious force of gravity. Berkeley pointed out that Naming a thing and having equations to calculate and predict about it does not require a basic understanding of the actuality involved. The gravity concept and the energy concept are still in this state.

My thoughts on the statement "it only exists while being perceived" are that it does not mean that the object observed disappears from the realm of reality when it is not being observed by a particular observer. It only means that the thought of the object may not be in the conscious realm of

the mind of the observer when his attention turns to some other object. Berkeley apparently did not think this way, because he eventually turns to God to be the continuing observer, and claims that Truth is that which corresponds to the reality perceived by God. This again puts God outside of nature. This is his solution to Locke's dilemma about Truth being that which corresponds to the reality, but cannot be known. It also led to the following response.

Dear Sir, I find your astonishment odd The tree in the quad
continues to be Since observed by yours faithfully God.

Immanuel Kant, about 1770, was impressed by Newton's mathematical model and tried to explain its success and understand its limitations by dividing knowledge into 3 parts, appearance, Reality and theory.

The first, appearance, was the content of our direct sensory experience of natural phenomena, was deeply conditioned by the human sensory and intellectual apparatus.

Reality, the second part, which he called the "thing in itself", provided the appearances that were processed by the mind into the scientific facts. These facts are the mixed product of the observer's human nature and an underlying reality. Kant felt that the participation of the human mind in the creation of experiences explained both the remarkable ability of human concepts to fit the facts, and the natural limits of such abilities.

Theory, the third part, was the combination of facts and concepts . Since both facts and concepts have a common origin, the human mind, we can only explain those facts about the world that we have brought to it. Thus, any underlying reality will be forever inaccessible. We can know only that part of reality that we have created with our minds.

He said no one can experience space & time, but admitted to existing in space and time.

On the question of the Limits of Knowledge, Kant asked what the senses can perceive. His answer was that the senses perceive phenomena, which is the world of appearances. He did not say the phenomenal world was not real, only that our knowledge is limited to it. What we claim as the consequence of a sensory experience is merely the meaning that the mind assigns to the experience. He did say that the phenomenal realm was the realm of scientific inquiry.

Kant also, following Plato and Augustine, supported the idea that the mind contains innate categories for everything we can experience from reality. Some of these innate categories, contain knowledge about reality aspects, like space & time, that we cannot directly experience.

Laplace, another mathematician, about 1790, rescued the solar system model of Copernicus & Kepler from failure by showing that the planetary orbits were stable. The great success of mathematical models in providing explanations of almost all natural phenomena was so impressive that Laplace and others decided that nature had been so well explained that the God concept was not needed. Laplace is credited with removing both the theological and metaphysical components from science.

He also insisted that the hypotheses formed from evaluated data were not to be treated as real until confirmed by observed data of the phenomena. This was a critical step in creating the current scientific method.

Since many scientists and philosophers had decided that the Phenomena could be saved without resorting to God, they espoused a new theory of "Gradual Spontaneous Creation" of things or Reality. The "Gradual " was to allow time for chance events to accumulate. This theory allowed many to escape from the requirements of theology in proposing answers to the problems of origin.

1. The idea that Phenomena could be saved without resorting to God. Several
2. The idea of Gradual Spontaneous Creation of Reality. Several
3. The idea that the mind assembles facts & concepts into theories. Kant

THE 19TH CENTURY: THE CLASSICAL WORLD STARTS TO FALL APART

The idea that the world was made of standard little parts originated in Antiquity. Democritus, about 500 BC. Somewhat later, the idea was "everything could be constructed from different forms of one or a very few basic things like air, earth, fire, or water used individually or in combinations. This idea lasted until the early 19th century.

In 1808, Dalton had found that chemical substances combined in fixed ratios and proposed that this fact was due to the elements existing as individual atoms. Some scientists accepted this explanation but a few thought the proposal went far beyond the facts. They claimed the facts only supported the idea of a so called chemical equivalent, not some physical entity hidden behind the facts. Further, since the proposed atom was smaller than the wavelength of light, there was no possibility of its existence being verified.

In 1864, Maxwell discovered the equations that described the phenomena of electricity and magnetism and identified electromagnetic wave fields. Maxwell's equations allowed him to calculate a wave velocity which turned out to be the same as the measured velocity of light, so he concluded that light was an E-M phenomena. He further surmised the existence of invisible E-M waves of different frequencies.

The question of what medium these waves traveled in was of major interest. Because visible light was an electromagnetic wave that came from astronomical objects thought to be great distances away, the medium, whatever it was, was named the Luminiferous Ether.

Such a stuff must have certain properties. It must be stationary and permeate all of space. It must offer very little or no friction to the movement of physical bodies through it, so the viscosity of the ether must be very low but another well established theory said that the velocity of waves in a medium was directly related to the viscosity of the medium, and since the light velocity was so great, the viscosity of the ether must be enormous, in sharp contradiction to the previous statement.

In 1887, Michelson & Morley, responding to this minor crack in the classical facade, conducted an experiment to measure the motion of the earth through the ether. To the great surprise of everyone, the experiment failed to detect any motion through the ether. The numerous and varied attempts to explain this failure all failed, but so ingrained was the concept that waves can only travel in a medium that the existence of the ether was never questioned. Lord Kelvin, several years later, said, "One thing that we are sure of, and that is the reality of the lunimiferous ether." This problem was resolved in the early 1900s.

In 1895, Oswald, who had tried, with little success, to use the ideas of thermodynamics to explain Dalton's fixed combination ratios, said, "We must renounce the hope of representing the physical world by referring natural phenomena to the mechanics of atoms. The task of science is to discern relationships among Realities, that is, demonstrable and measurable quantities. It is not a search for forces we cannot measure acting between atoms we cannot observe." For him, Reality was demonstrable and measurable.

Then in 1897, Thomson discovered a part of reality that came to be called an electron. It could not be seen, but its effects in gases could be seen. He said it could accumulate kinetic energy, had a negative electrical charge, a very small mass. To this date, all attempts to measure the size have failed. It appeared to come out of solid matter and was later identified as the carrier of electrical current.

At the end of 19th century, Classical Physics had explained almost everything. Not only did it seem to explain all the facts, but it did so in ways that were clear and could be pictured in the mind.

Classical physics needed only 2 real entities, matter and force fields. Only 2 force fields were known, Gravity and the electromagnetic field. Both were inverse square fields that extend throughout all space because they never get to zero strength. Only 2 kinds of laws were needed. Newton's Laws of motion that told matter how to move in a force field and Maxwell's Field laws that describe how each field depends on its material source and how it extends into space.

There were a few problems yet to be worked out.

The either problem.

The Black Body problem of why a hot solid glows red when all classical calculations say it should glow blue.

The Photoelectric Effect problem of how light could immediately eject electrons out of some metals was not understood. It was known that it took a certain minimum amount of energy to eject the electron from the metal surface. It was also known that the energy in a light wave was distributed along the wave so at low light intensities it should take some measurable time for the wave to deliver enough energy. The experimental evidence showed that if the light was of a color that would eject electrons at a high light intensity, decreasing the light intensity never produced the expected delay between light incidence and electron emission. A few electrons were always emitted immediately.

The Brownian Motion problem concerned the source of the motion of small particles visible under the microscope. The classical laws said that on the average, the same number of un-seeable particles must bombard every side of the viewed particle resulting in a zero net force. Thus no motion should occur.

THE 20TH CENTURY: THE COLLAPSE GAINS SPEED

In the first half of the 20th century scientific discovery dominated the conversation about reality.

In 1900, M Planck took up the Black Body problem. He knew from Maxwell's work that the energy in an E M wave was related to the frequency. He found that he could predict the output spectrum of a hot black body only if he restricted the frequencies of the E M waves to certain discrete values. He was able to calculated the value of the constant that gave the correct color spectrum. Other physicists ignored Planck's result because Maxwell's Laws said the light waves could have any energy and frequency. This was a another crack in the classical facade.

Then in 1905 Einstein published 3 papers.

The one on Brownian Motion pointed the way to experiments that eventually established the existence of atoms. Since Einstein's theory showed how the induced motion would vary with temperature and particle size, it implied that it would be possible to count the number of atoms

involved. In 1913, Perrin verified Einstein's model by counting the number of atoms in a drop of water. After Einstein's paper and Perrin's verification, Oswald conceded that the Atomic Hypothesis had been verified.

Another of Einstein's 1905 papers explained the Photoelectric effect by assuming that, if the light striking the metal kicked an electron out immediately, the light must deliver the required energy immediately, thus the light energy must be delivered in packets. These packets contained light energy of discrete values given by Planck's assumption.

Slightly later, Compton, studying light scattering by gases was able to show that the entire relationship between the light entering the gas and the scattered light & electron detected after the interaction could be described as if the light was a particle or light packet of classical momentum with values restricted by the wave length of the light.

These 2 papers cracked the classical claim that light was a only a continuous wave, and established the dual wave/particle nature of light, and eventually of all E-M radiation.

Shortly later, DeBroglie proposed that material particles would show wave properties with the classical energy and momentum of the particle related to the wave frequency and wave length. Einstein supported this proposal and the wave length of the electron was measured shortly after. Now, the only subatomic particle known was shown to also act like it was a wave. Another duality had further cracked the classical facade.

Einstein's third paper contained his new theory on space and time, which is now known as the Special Theory of Relativity. One of the cornerstones of his theory was that only relative motion between things were important to the laws of physics. There was no absolute frame of reference in the world or universe. This being the case, it would be impossible to observe the absolute motion of bodies through space. Thus the above attempts to observe the earth's motion thru the ether should fail. Suddenly, the small cracks in the facade were revealed as a crumbling major pillar of classical reality.

Einstein's theory did have some absolute physical attributes, and all valid covariant physical laws must be built from these absolute quantities. Only in this way can the laws be the same for all observers. Since a covariant theory of the ether could not be found, the concept of the Ether was eventually discarded. The questions about how E M waves propagate is still with us.

Now that both matter and E M fields had been shown to be dualistic, everything seemed to be made of the same stuff, whatever it was. We were back to the idea of the Ancient Greeks. By 1925, the reality of the classical physics world had essentially been destroyed. But most did not realize this at the time.

The advent of Quantum Theory in the 1920s wrenched physicists and philosophers out of centuries old thought patterns and compelled then to consider something new. But what? The distress of this reorientation continues to this day as the reality crisis. and is demonstrated by the wide range of different realities proposed, all based on the same small set of undeniable facts.

Quantum Theory has now shattered the Newtonian Clockwork model and most scientists are now sure that the world is not deterministic. But they don't know what to replace this old model with.

Quantum Theory, despite its enormous success, so far fails to provide a single acceptable new metaphor for how the Universe works, So the search for Reality or “How the world really is.” is an ongoing enterprise.

Bohr commented that we cannot come up with new ideas because our thinking is restricted by our past experiences.

Feynman said, “I think it is safe to say that no one understands QM. Nobody knows how it can be like that.”

I will finish this part with a quote from Saul-Paul Sirag who, when discussing the Quest for Reality, said,

> “The essential point in science is not a complicated mathematical formalism or a ritualized experimentation. Rather the heart of science is a kind of shrewd honesty that springs from really wanting to know what the hell is going on!”

The End for Now