11A The Strange World of Quantum Mechanics

Introduction

Over the past century the most amazing scientific discoveries seem to have occurred in the region of the very large (galaxies and solar systems) and the very small (the subatomic realm).

Stephen Gimble describes the following discoveries that changed our perceptions of reality:

- The atom, fundamental building block of all elements, is mostly open space.
- Photoelectric effect- strange interaction of light and matter which releases electrons.
- Electrons- The fundamental negative particle of the atom has properties of both a particle and a wave.
- Energy emitted and absorbed in an atom occurs only in fixed amounts.
- Velocity is dependent on the frame of reference.
- Time slows down and mass increases as you approach the speed of light.
- Space and time – should be absolutely stable features of the universe, yet Einstein showed that they are strangely fluid and linked together in a 4-dimensional space-time manifold.
- Space-time is expanding.
- Mass and energy- two basic concepts of physics. Both are conserved in reactions, yet Einstein showed that mass can be converted into energy.
- Einstein incorporated gravity into general relativity. Matter and energy warp space-time.
- Matter- Quantum mechanics showed that subatomic particles may exist in multiple places and states until they are measured.
- Particles packed at the maximum possible density produce a “black hole” from which entering light could never emerge.
- The standard model of particle physics (from quantum field theory) includes fermions and bosons as fundamental particles of the atom.
- The Higgs boson (verified in 2012) gives mass to other particles.
- Galaxies are more massive than the total mass of their stars. “Dark matter,” unobservable matter, must be present.
- Fields are more basic than matter. [1]

Of all the areas of modern physics, Quantum Mechanics (QM) is certainly the most unusual, with findings that seem almost bizarre and appear to have implications for spiritual life.

History and Concepts

Quantum physics began in 1923 with the theory of wave-particle duality, based on the observation that light (a wave) sometimes acted like a particle. Soon electrons (particles) were found to exhibit properties of a wave.

Early investigators included the top guns of physics: Niels Bohr, Max Planck, Albert Einstein, Paul Dirac, Werner Heisenberg, and Ernest Schrodinger.

In 1930 Paul Dirac wrote *Principles of Quantum Mechanics*, which changed the world of physics. Quantum effects are real, and are foundational for lasers and semiconductor devices.

At the subatomic level a number of strange things occur:

1. Electron energy levels are not continuous, but occur in specific amounts-"quantized".
2. The maximum number of electrons in each energy band is fixed.
3. No two electrons in an atom can have identical orbital positions and spins.
4. Electrons and photons behave as both particles and waves.
5. It is not possible to know simultaneously both the position and the moment (momentum) of an electron. (Heisenberg's uncertainty principle).
6. An electron is not localized at a specific point in space at a specific time. Instead, it has a probability of existing there. The electron is envisioned as being in multiple "places" or states at once.
7. Only when we measure (observe) the electron does it have a real location – The activity is known as "the collapse of the wave function."
8. Two electrons that are linked in an atom are still intertwined even when separated by huge distances.

Wave-particle duality

The wave-particle nature of the electron was discovered in a series of experiments that built upon the particle nature of electrons: (Releasing a single photon per electron in the photoelectric effect, associated with a quantifiable mass and quantity of charge per electron). However, when the electrons were passed through a double slit they created an interference pattern which is common to waves.

"The electron must be neither a pure particle nor a pure wave, but something else that we don't understand. It seems more like a particle or like a wave "depending on conditions (Bohr's complementarity.)" " [2] On the quantum level "it seems impossible to observe reality without changing it." [3]

Heisenberg's principle

Werner Heisenberg –the "uncertainty principle"- Unlike objects at scales that we can see, electrons cannot be fully characterized in real time. We can either know the position or else the

momentum of an electron, but not both simultaneously. Might the electron exist in multiple states simultaneously?

Mathematically, the uncertainty principle was stated this way:

$$\Delta x \ \Delta p \geq h/ 4\pi$$

(This) means that the uncertainty in our knowledge of the position of a particle, multiplied by the uncertainty of our knowledge of the momentum, is always equal to or greater than h/4π, where h is Planck's constant, a very, very, very small number. That Heisenberg was able to precisely quantify the indeterminacy in this way was truly remarkable. [4]

The concept has led to various collegiate jokes about Heisenberg:

Sign on a building in Germany: "Heisenberg may have slept here."

Sign on a college auditorium: "The lecture on Uncertainty by Dr. Heisenberg will either take place in this auditorium sometime this week or will occur at exactly 2 P.M. somewhere on campus."

Schrodinger's cat

Erwin Schrodinger proposed a famous "thought experiment":

Imagine, if you will, a cat placed in a sealed box along with a radioactive isotope and a vial of poison gas. At some point the radioactive decay will bring about the release of the gas, instantly killing the cat. From the outside you can't know if the cat is alive or dead until you open the box. In a sense, the cat is both alive and dead until the box is opened. Similarly, the status of an electron is unknown until we measure it. (Schrodinger probably should have put an anteater or an armadillo in his box, since few people are much attached to those animals.)

Electron entanglement

(Consider) a pair of protons (or electrons) whose quantum spins cancel out (one up, one down). Now separate them and measure the spin of one proton. Measuring the spin of one proton 'collapses' the wave equation and determines the spin of the other. It appears that a measurement in one pace can have an instantaneous effect on something that might be light years away. [5]

Einstein called this effect a "spooky action at a distance" which, he said, could never occur and published the argument as the EPR paradox (Einstein-Podolsky-Rosen). Surprisingly, in 1982, Alain Aspect and his team demonstrated the reality of electron entanglement when the particles were separated at a distance over a kilometer. [6]

Interpretations

These unique aspects of QM have given rise to at least four different interpretations of QM-

1. The "Copenhagen (traditional) interpretation," championed by Niels Bohr. This is the most famous and most widely-accepted interpretation of effects at the subatomic level. The human observer actually affects-even causes- the subatomic action.

2. The "many-worlds interpretation" developed by Hugh Everett.
   At each point of observation or decision the universe splits into two or more universes, one for every possible outcome. All possibilities always exist simultaneously. The result is an infinite number of parallel universes (or "multiverse".) Not only are material objects duplicated but space and time are duplicated as well. [7]

   The duplication of worlds extends to human choices. Suppose you are faced with a choice-tea or coffee? The Everett interpretation says that the universe immediately divides into two branches. In one of the branches you have tea, in the other coffee. This way you have everything! [8]

3. The "participatory universe" theory, developed by John Wheeler.

John Archibald Wheeler had collaborated with Niels Bohr on fission mechanisms, defined black holes, and puzzled over many paradoxes of quantum mechanics. (ref) He was particularly interested in the conclusion that observation itself alters the state of an electron. The scientist, he concluded, moves from being an observer to being an "active participator." "In some strange way the universe is a participatory universe." [9]

In Wheeler's system,

- The quantum effects did not exist until they were observed.
- We actually create the past by measuring it.
- We actually created the universe by observing it.
- The universe is constantly being observed and is simultaneously observing us.

4. The "hidden variables" interpretation, developed by David Bohm, in line with Einstein's original concerns with QM.
   Somehow we don't have a complete knowledge of what's happening at the subatomic level. Variables presently unknown to us may enter and affect the outcome. Bohm also made a case for the interconnectedness of all matter.

Philosophical/Theological Observations and Questions

With quantum mechanics,

- Things happen on a different level (subatomic) and are not logically intuitive.

- Things happen that are not necessarily predictable.
- Things happen that seem to defy common sense.
- Things can be explained that previously were considered mysterious and unknowable.

These same things are often said of God's actions and miracles. [10]

QM also prompts huge questions:

- Is QM so bizarre that God couldn't have created it?
- How does the action of observing affect what is being observed?
- Does QM imply free will?
- Does QM imply personality in the universe?
- (If) every time a quantum event occurs a whole new universe is created to allow for all the statistical possible outcomes, where do all these universes come from? [11]
- What does quantum indeterminacy imply with respect to the omniscience of God?
- What does the Copenhagen interpretation of Quantum Mechanics mean in terms of God's foreknowledge? [12]
- Might God govern the universe partly at the subatomic level, an area that would be scientifically invisible to us? [13]

Mystical/Pantheistic Interpretations

Since the findings of Heisenberg and Schroedinger were so unusual, suggesting that in the extreme that the observer is creating reality, some writers have looked for a New Age explanation of quantum physics. This idea has led physicists like Gary Zukav and Fritjov Capra to link quantum mechanics to Eastern-pantheistic thought. The worldviews held by the founders of QM significantly impacted their interpretations of quantum effects.

Bohr presented a concept he termed "complementarity": the idea that two contradictory conditions (for example, particle and wave) could exist simultaneously. Physicist Wolfgang Pauli celebrated the idea of "irrationality" and decried the Western-Christian mindset for being too rational.

In light of sub-atomic "Uncertainty" difficulties, a scientist named Niels Bohr from Copenhagen (Denmark) went much further in his philosophy of physics, by saying that the electron does not actually POSSESS the attributes of position or velocity until one or the other is observed by the experimenter. -- You see, Niels Bohr worked from a basically Hindu (Eastern) worldview, and he championed this "Copenhagen" interpretation of sub-atomic physics, which essentially stated that in the absence of an observer, reality actually does not exist... or to say it another way, the act of observing CREATES the reality. He thought the observer created the quantum event and

the way those sub-atomic particles behaved.
---This is very much like the old question which states:

"If a person is not there to observe and hear it, does a tree which falls in the forest and make any sound?" Bohr would say "no" --on the quantum level, at least. [14]

"The basis of quantum theory is more revolutionary yet: It asserts that perfect objective knowledge of the world cannot be had because there is no objective world." [15]

Does the observer create what he/she observes? Yes, says physicist and new age thinker Fritjof Capra*: "The electron does not have objective properties independent of my mind."* [16] *(Capra, quoted in Soul of Science, p.193)* Capra's Tao of Physics and Gary Zukav's The Dancing Wu Li Masters link quantum effects to pantheistic concepts. *"Capra goes so far as to claim that modern physics supports the mystical worldview of Eastern religion, which treats the material world as a center of consciousness."* [17]

Zukav writes:

"The old physics assumes that there is an external world which exists apart from us. It further assumes that we can observe, measure, and speculate about the external world without changing it…Quantum mechanics…leads to the possibility that our reality is what we choose to make it." [18]

"This is not only different from the way we have looked at the world for 300 years, it is opposite…What we experience is not external reality, but our interaction with it…The world consists not of things, but interactions." [19]

The interpretations by Everett and Wheeler lead easily to mystical extrapolations.Capra's position is clearly mystical:

This view, again, is in perfect harmony with the views of the Eastern mystical traditions which have always regarded consciousness as an integral part of the universe. In the Eastern view, human beings, like other life forms, are parts of an inseparable organic whole. Their intelligence, therefore, implies that the whole, too, is intelligent… In us, the universe repeats over and over again its ability to produce forms through which it becomes consciously aware of itself. [20]

Gardner critiques the application of QM to "mind over matter" experiments/"science" (parapsychology/paraphysics):

For many paraphysicists the EPR paradox suggests that quantum information can be transferred instantaneously (or almost so) from any part of the universe to any other, otherwise how does one particle "know" what happens when its twin is measured? (Relativity theory is not violated because no energy is transferred, only information.) [21]

Further, Nick Herbert uses the EPR experiments to suggest that quantum physics indicates that all is one (monism). [22]

Part of the difficulty in dealing with classical physics and quantum physics is the emphasis of quantum physics on the conglomerate interactions of multiple pieces. "Whereas classical physics exaggerates the role of parts, (Ian) Barbour argues, people like Capra exaggerate wholes." [23]

Quantum interpretations are actually more metaphysical than truly physical. Rather than being moved to a position because of the results discovered, scientists have groped for an explanation of actions that don't match up with physical world. "Illusion", "oneness," "irrationality," and "consciousness" were ideas that emerged from the background of the physicists involved.

The sense of "intelligence" throughout the universe that Capra wants to build upon could be more readily explained as originating with our Creator than with then universe itself.

QM may only reveal human limitations to our ability to describe, observe, or measure with perfect accuracy. No one has demonstrated that our observation alone can change reality. The Schroedinger cat experiment is ultimately not about consciousness: It requires us to take an action and open the box.

Quantum theory may be friendly to pantheism, but it is also friendly to a host of other worldviews. The new physics no more proves the new-age philosophy than it proves any of the others. At its heart new-age philosophy is nothing more than old-age pantheism. Such a worldview founders on the basic problems traditionally faced by eastern religions: the question of evil, the problem describing how individual self-consciousness can arise from a universal, impersonal force, and so forth. [24]

In spite of his bizarre theory of the universe John Wheeler was no fan of mysticism. In a paper presented to the 1988 American Association for the Advancement of Science Wheeler concluded: "Let no one use the Einstein-Poldolsky- Rosen experiment to claim that information can be transmitted faster than light, or to postulate any 'quantum interconnectedness' between separate consciousnesses. Both are baseless. Both are mysticism. Both are moonshine." [25]

QM and God's Omniscience

One of the toughest difficulties arising from a random variable approach to electrons is this:

If God created electrons to be absolutely random in position, does God Himself know the position and motion of a given electron? Is this an area of knowledge unknown to God? Do subatomic particles violate the omniscience of God?

This seems akin to asking if God could make a rock so big that even He couldn't lift it. What we perceive as random is no barrier to God's knowledge.

Does God know what will happen at the subatomic level? If we say yes, then it's not really random. If we say no, then God is really not all-knowing.

That which is statistically uncertain to us is not uncertainty to God.

God created the subatomic world and maintains it perfectly. He may or may not need to know the position of every electron, but that information is not a mystery to Him (as it is to us.)

Statistical uncertainty at the atomic level does not equate to uncertainty at the level of real objects.

Does the Heisenberg Uncertainty Principle negate God's omniscience? Some have raised and debated this question:

Our lack of understanding of the inner workings of the atom really says nothing about God's knowledge of electrons. (He made every bit of it, after all.) Heisenberg's principle should probably not be expressed as "We cannot know both the location and momentum of an electron," but rather, "We cannot determine" or "We cannot simultaneously measure" both quantities. [26]

QM and Prayer

Some writers have suggested that quantum mechanics with all its strange aspects might explain or help us to understand spiritual realities, especially prayer. [27]

- Does my awareness of something causes it to exist?
- Do we typically find what we hope to measure?
- Does quantum mechanics explain the "time-warp" aspect of prayer?

We need to be very careful here. Only God can cause things to exist. My words and thoughts may relate to my feelings but can never actually create reality. Prayer is always communication an infinite Person. A personal God who is not bound by time and space can easily cause a chain of events in the past to bring about the answer to the prayer I pray tomorrow.

Cautions-

- Faith is not a force.
- Our words can't create reality.
- Prayer itself doesn't make things happen. God makes things happen, often in answer to prayer.

Most discussions focus on prayer as expressing desires. Prayer is really communication God and includes not only asking but praise, thanksgiving, confession, seeking God's will, desiring God's kingdom, and listening for instruction.

QM and Free Will/God's Sovereignty

Does quantum mechanics imply anything about free will? Some physicists have suggested that the seemingly random electron motion inside the atom is consistent with free will.

In a completely mechanistic universe everything would be predetermined (by scientific laws), including all of our actions. The discoveries of QM, specifically the indeterminacy of electron action, supposedly opened up the possibility of Human "free will" for physicists. (Eddington and Compton proposed this idea….)

When physicists observed that behavior at the atomic level was fundamentally indeterminate, the universal validity of classical physics, as well as philosophical determinism came into question. Physicists recoiled at the idea that their science could no longer claim to predict all things with infinite precision. But, that's what quantum mechanics teaches us. We absolutely cannot know exactly how something will turn out before it happens. [28]

The electron exists as a wave, with several possibilities available to it, until it is observed and the wave function is collapsed, and the electron is forced to choose one path above the others…This idea was repulsive to many scientists at the time, and many still struggle with it. After all, if the choice of which future will be adopted upon observation is truly random, then perhaps humanity is in the same state. [29]

Mathematicians John Conway and Simon Kochen have proposed what they term the "Strong Free Will Theorem" [30] "(This theorem) states that if the physicist has free will…then the electron has free will and 'decides' non-randomly what the outcome will be upon its quantum measurement." [31]

Does randomness/uncertainty in the location of subatomic particles suggest free will? Not necessarily. Human "free will" suggests cognition, conscious awareness, intentionality, and the ability to carry out a decision. Electrons don't consciously "decide" where they'll move to. Random motion can't produce deliberate action. The location of an electron within an atomic crystal is nothing at all like the myriad of choices available to human decision.

Even if our brain activity involved indeterminate quantum level activity, this still wouldn't provide us with the free will we experience on a daily basis. If the events in our brain are indeterminate and random, how could we ever trust our thoughts as our own? How could we be in control of our actions if the thoughts guiding these actions are indeterminate? Quantum indeterminacy doesn't help us to understand our thoughts, choices or actions. If our thoughts and choices are truly independent of any *cause, "every thought and action would seem to merit the statement, 'I don't know what came over me.'"* [32]

Furthermore, God is not bound by time. This concept alone changes the entire dynamic of determinism.

God's perspective on time is undeniably different than our own. God is outside of time, so time is irrelevant to God. Human history, which we see as a unidirectional vector, may be seen by God as a line. Every event that has taken place, is currently taking place and will take place is not necessarily seen in sequential order; instead, all events are occurring simultaneously. [33]

Oakes writes:

I lean toward a consistent view of God in how he works on all levels. I see a God who created a universe with a kind of "free will" on all levels, yet who, at the same time, will intervene in order to bring about his will. Yet, this intervening seems to be very rare, and in an amazingly brilliant way that somehow finds the perfect balance between God's sovereignty and our free will. I agree with Thomas Aquinas on free will when he says, in essence, God's sovereignty is manifest, both in the things which obey God naturally and in those things to whom God sovereignly grants free will. In other words, it is God's sovereign will that we, as humans have sovereignty within the realm of our own lives. [34]

QM and Causality

Causality requires that every result have a cause (existing prior to the result).

Geisler [35] has argued that Heisenberg's principle does not, in fact, contradict the idea of causality. Heisenberg was making a case for unpredictability. There can be a cause for the behavior of subatomic particles, even if we can't predict their location.

Some scientists argue that the principle of causality is not valid in light of modern quantum physics. They say that the principle of causality breaks down at the subatomic level of reality, and Heisenberg's uncertainty principle is reference as the basis for their opinion. Therefore, according to these scientists, if causality does not exist at the most fundamental level of reality (the subatomic level), it must be invalid at all other levels as well. In other words, if causality does not exist at the smallest level of reality, why should it exist at the largest level – the cause of the universe? [36]

QM and Creation

Define quantum tunneling

In quantum tunneling particles are somehow able to penetrate barriers. Particles seem to be brought into existence from "vacuum fluctuation". Might the universe have suddenly popped out of nothing, form quantum foam fluctuations? Some suggest that quantum tunneling explains creation and eliminates the need for a Creator

How could such a "flash of universe" have appeared? Quantum electrodynamics

affirms that an electron, positron, and photon occasionally "emerge spontaneously" from a "perfect vacuum." And when this spontaneous generation occurs, "the three particles exist for a

brief time, and then annihilate each other, leaving no trace behind." Such a spontaneous, temporary emergence of particles from a vacuum is called a "vacuum fluctuation," and is, according to Tryon, "utterly commonplace in quantum field theory." It seems that, as the authors of a 1979 article in the Scientific American observe, vacuums are full of all sorts of things called "virtual particles. [37]

But is this the case? We are still forced to explain the origin of the "quantum foam" or "virtual particles" (which last only a trillionth of a second).

It does not follow that events above the subatomic level do not have causes. Even if one grants that a photon of light can pop into existence from a "quantum ghost" (sheer nothingness that underlies everything), it does not follow that the first event did not need a cause… It is an unwarranted extrapolation to argue for the microlevel [quantum effects] to the macrolevel [creation of a universe]. [38]

Ross writes:

Noting that virtual particles can pop into existence from nothingness through quantum tunneling, (Paul) Davies employs the new grand unified theories to suggest that in the same manner the whole universe popped into existence. Ironically, his argument against God's creating can now be turned against his hypothesis. Quantum mechanics is founded on the concept that quantum events occur according to finite probabilities within finite time intervals. The larger the time interval, the greater the probability that a quantum event will occur. Outside of time, however, no quantum event is possible. Therefore, the origin of time (coincident with that of space, matter, and energy) eliminates quantum tunneling as "creator." [39]

(I)f a theory cannot predict actual outcomes it cannot impart to us perfect knowledge. Thus, it is highly suspect to employ quantum physics to attack the existence of God. This is a strong argument against the New Atheists who claim that quantum mechanics 'tells us' a universe will appear from the void… [40]

QM and Relationships

In one of the newer interpretations of QM ('the Ithaca Interpretation of Quantum Mechanics") David Mermin of Cornell has proposed that individual objects can exist but only the *relationships* between them can be known.

Christian readers of Mermin suddenly find themselves in familiar territory. For any deeply Christian account of the creation seems bound to have a relational quality...And the universe exists, Jewish and Christian theologians have long asserted, in continuous, dynamic, loving relation to God…Under Mermin's interpretation, at least, QM turns out to be as much as ally as a foe to the Christian understanding of the world, and some of its most "irrational" elements actually compel a more relational rationality. [41]

According to Christian doctrine, God is fundamentally relational. God is one, yet God is also Trinity; God is three persons enfolded in a relationship of perfect love…A relational God is likely to create a relational world. As Polkinghorne rightly says, this is indeed not to prove that God is relational, or that theology can make predictions from its doctrines about the physical world, but it is to say that theology and science fi together very comfortably and are far from contradictory. [42]

Christian Interpretations

While Heisenberg's uncertainty principle was a blow to Newtonian determinism and the ability to predict all things physical it should not be a roadblock to believers: "From a Christian perspective, such an encounter with limits should remind us of the fundamental distinction between an infinite Creator and a finite and limited creation, including mankind." [43]

"Observer" is probably an unfortunate choice of words. It's not like scientists were sitting and watching (or evenly suddenly watching) the electron to see what it would do. It is not the action of being thought of or being "observed" that is critical in quantum effects. It is the action of being measured or detected with our instruments that affects and alters subatomic particles. We use matter to measure matter, and what we measure is far smaller than any of our measuring means. "It is as though one were trying to locate a billiard ball by either rolling a basketball at it or throwing a baseball at it." [44]

Flaws in the interpretation of QM:

Quantum mechanics merely shows us that in the micro world of particle physics man is limited in his ability to measure quantum effects… In choosing to determine the position of the entity, the human observer loses information about its momentum.

The observer does not give "reality" to the entity, but rather the observer chooses what aspect of the reality he wishes to discern. It is not that the Heisenberg uncertainty principle disproves the principle of causality, but simply that causality in this case is hidden from human investigation.

Quantum mechanical limitations apply only to micro, not to macro, systems. The relative uncertainty approaches zero as the number of quantum particles in the system increases. Therefore, what is true for a quantum particle would not be true for the universe as a whole.

The arrow of time has never been observed to reverse, nor do we see any trace of evidence that a reversal might have taken place beyond the scope of our observation.

Time and causality move inexorably forward. Therefore, to suggest that human activity now somehow can affect events billions of years ago is nothing short of absurd.

Intelligence, or personality, is not a key factor in the observation of quantum mechanical events. Photographic plates, for example, are perfectly capable of recording such events.

Both relativity and the gauge theory of quantum mechanics, now established beyond reasonable doubt by experimental evidence, state that the correct description of nature is that in which the human observer is irrelevant. [45]

House writes:

The Copenhagen interpretation of quantum mechanics…requires those who adhere to it consistently to deny three principles taught by natural revelation, which are indispensable presuppositions of Christian belief. :

- Realism- that which is true is true regardless of whether any human is aware of it
- Contradiction – something can't be true and untrue at the same time
- Causality- for every effect there is a cause [46]

Meyers takes a second look at the difficulty (impossibility?) of determining causes at the subatomic level:

Quote-

Is it proper to presuppose mechanical (physical) causes for all subatomic events? It may be that with quantum mechanics we have reached the threshold of mechanical causal relationships within the physical world…

Must everything in the created world be reduced to mechanistic interactions between particles? Need nonmechanical causes be identified with the occult?...Might there be nonmechanical causes for subatomic events that originate outside the created order? Maybe the atomic pie cannot be sliced any further. ..Could the uncertainty principle be telling us we have really reached the the limit of the physical, created causal chain? ..Isn't it possible that God, who "upholds all things by the word of His power" (Heb. 1:3) is directly responsible for subatomic events? [47]

Conclusions

In summary,

1. The universe is far more complex and unpredictable than scientists had originally imagined.

2. The basic effects observed at the subatomic level are verifiable and are used in the development of transistors, lasers, MRI devices, and quantum computing. It is the explaining of these effects that causes us problems.
3. One key to dealing with quantum mechanics is the realization that activity at the subatomic level doesn't match activity at the human scale.
4. We don't really have the terminology to describe what's going on with basic particles – hence, we wind up with terms like "colored" and "charmed" particles and speak of "observers."
5. Physicist Richard Feynman once suggested that no one really understands what's going on in quantum physics.
6. If we had full knowledge there wouldn't be uncertainty in any of the areas. If we were the cat in Schrodinger's box we would know whether we were alive or dead, even if the person outside didn't. If we knew all the details concerning the radioactivity and the gas we could predict the instant of the cat's death.

There is no justification for applying concepts of QM to human action, free will or determinism, or to any objects of greater magnitude than the atomic scale. What underlies all of physical reality is unseen, unpredictable, and only minimally understood.

We must be very careful about linking quantum effects to God's working with humans. The key idea, which is valid, is that what underlies all of physical reality is unseen, unpredictable, and minimally understood.

We don't want to suggest that God can change (open theism theology). We change; God's workings change; but His character, His promises, His covenants, and His kingdom goals never change. He is "I AM." ("I am the Lord- I change not.")
Open theism has been well-refuted by H. Wayne House and others. [48]

We don't want to suggest that the Bible is not essential. God uses nature, conscience, The Holy Spirit, and the Body of Christ to reveal Himself, but scripture is His word, His standard. We test ideas against God's truth. We test prophecies and spiritual insights against God's truth.

We don't want to suggest that faith is a force or a substance. Faith is the noun form of the verb to believe, to trust, to rely on.

We don't want to suggest that our thoughts directly change anything. Our thoughts affect our speech and our muscles, which then cause our actions. Our thoughts are not our prayers. Our words don't cause things to happen. Our prayers don't change things directly. They are personal communications with God Himself- Who *does* change physical reality.

Quantum physics is like the supernatural realm but is not identical to it. If we thoroughly understood quantum physics we still could not produce miracles. God creates out of nothing at times.

Even though sin occurs and is never God's desire for us, our choices are real and consequential. God can be in absolute control of the world and yet allow humans to make free choices.

God is absolutely predictable in His salvation of sinners, in His love for us, in His perfect holiness- and yet God is absolutely unpredictable in the circumstances of life and in how He manifests His presence.

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