

Science and Religion: The New Dialogue

Week 5: God and the New Physics: Quantum Mechanics, Chaos Uncertainty and What They Mean

**Science and Religion: The New Dialogue**

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**Lecture Five**

**God and the New Physics: Quantum Mechanics, Chaos Uncertainty and What They Mean  
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## **Review**

So we have seen that the myths of NOMA and “Warfare” are misleading. They have given us a badly distorted picture of the relationship between religion and science.

Contrary to the myth of NOMA, religious beliefs can and often do overlap with scientific findings. Because they overlap, there is potential for conflict, and when they conflict, something has to give. However, contrary to the myth of “warfare,” the major discoveries in modern science do not conflict with Christian faith as it has been understood within the classical theological tradition. To the contrary, the better we understand our own tradition, and the more seriously we take it, the more we find that faith and science cohere and coalesce within an integrated, comprehensive worldview.

As an alternative to the myths of NOMA and Warfare, on the cover of the journal, *Theology and Science*, one finds a bridge. That symbol is a much healthier and more accurate way to picture the religion-science relation. Hopefully, some day it could become part of a more constructive myth.

Philosophers say that knowledge is like a web. Our most stable and important beliefs constitute the core or center. In the Christian worldview, the core is our belief that the life of Jesus is God’s message to the world that, from before all worlds, “this is who I am.” That is why, as I said last week, the doctrines of the Incarnation, Passion, and Resurrection of Christ tell us who God is, and how God works, and why.

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According to our worldview, this is the center of all knowledge. Other beliefs and knowledge radiate from that core, from the inside out. But knowledge also radiates from the outside in. That is where we have our actual experience of life—the hard data of existence.

A growing body of scientific knowledge occupies the middle regions of the web. It includes facts, theories, methods, concepts, definitions, values. It always, for everyone, includes a wealth of deep assumptions. It always, for everyone, includes a large measure of faith: a decision to trust that certain things are true that one cannot prove. Science itself is based on faith in the world's intelligibility and our capacity to understand it. I say again—there is an enormous amount of trust at work in science. Just as there is reason in faith, there is faith in reason.

On this web, all these pieces are connected. Sometimes the connections are distant, sometimes they are close.

The new dialogue between religion and science is essentially a research program exploring possible religion-science connections. Typically, a researcher may start with some bit of science, then she asks what difference the results of that scientific inquiry would make theologically.

And that is what we will do today: start with some important discoveries in science, and then consider their theological implications.

## **Introduction**

Lets talk physics.

In the past century, there have been two areas in science that have seemed potentially very rich in their theological implications. The sciences are: chaos theory and quantum mechanics. This morning, we will consider the bearing both these sciences may have on three questions important in theology:

1. Does God exist?
2. How does God act?
3. Are human beings free?

## Chaos Theory

We will take chaos theory first.

A very curious thing about nature is that it has a certain inbuilt propensity to organize itself—to make order out of chaos.

I think of this sometimes when I see a flock of blackbirds, where the whole flock darts left, right, up, and down in quick orchestrated movements. I don't doubt there is a physical mechanism to explain this, but wow!

“Chaos theory” explains how complex, dynamic systems arrive at ordered patterns, when “the system leaps spontaneously into a state of greater organized complexity.”<sup>1</sup>

The theory's range of application is impressive, extending over dynamic systems of many sorts in several fields. In evolutionary science, it has helped explain such diverse phenomena as the structure of viruses, vertebrate embryonic development, predator–prey patterns, and the social skills of army ants.<sup>2</sup> In physics, the behavior of a tiny bead balanced at the top of an ultra-thin U-shaped

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<sup>1</sup> Charles Birch, “Neo-Darwinism, Self–Organization, and Divine Action in Evolution,” in *Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action*, ed. Robert John Russell, William R. Stoeger, and Francisco J. Ayala (Berkeley, Cal.: Center for Theology and the Natural Sciences, 1998), 235.

<sup>2</sup> Birch, “Neo-Darwinism,” 230–35; Peacocke, *Paths*, 99.

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wire has been considered as a problem soluble by chaos theory, as have snowflake patterns, and the  
dynamics of the global weather system.<sup>3</sup>

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<sup>3</sup> Birch, "Neo-Darwinism," 235; Peacocke, *Paths*, 99; John Polkinghorne, *Science and Providence: God's Interaction with the World*, rev. ed. (Philadelphia: Templeton Foundation Press, 2005), 39.

## **Interest to Theologians**

Unfortunately, that is just about the sum of my knowledge of chaos theory, and I can't tell you anything at all about its mathematics.

What I can do is tell you some ways that it has been considered theologically important, concerning:

- (1) Divine action theory (How does God act?)
- (2) The organic argument for Divine Design (Does God exist?); and
- (3) The question of free will (Are human beings free?)

We will take quick snap shots of those suggested implications.

## **Divine Action Theory**

Insurance companies speak of “acts of God.” Jung’s followers speak of “synchronicity.” Television preachers promise “miracles.” Oprah, or someone, coined the expression “it’s a God thing.” People report experiences of angels. These are all ways that people have, some taken more seriously than others, of pointing to times and places where it seems that God is active in the world.

I heard Nancey Murphy tell my sister there were really only two kinds of Christian: those who think God “does stuff” and those who think he doesn’t. She’s one of the ones who thinks he does, and so am I.

And then the question inevitably arises: “OK, How?”

Divine action theory is concerned with the question of how God actually does things in the world.

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Divine action theorists have been intrigued by chaos theory, because it shows that tiny differences in physical input—so minute as to be, even in principle, undetectable—can sometimes generate spectacular effects. You may have heard of Edward Lorenz’s “butterfly effect.”<sup>4</sup> Supposedly, a butterfly can beat its wings a certain way in Arkansas, and trigger a chain of events that leads to thunderstorms along the Riviera. (Nancey Murphy tells me that this actually isn’t true, so the butterfly effect may be a case of science becoming myth.)

What is true is that chaos theory shows that, in nature, a little bit of divine action could go a long way. This is going to be especially important for liberal theology.

If you remember, I said a few weeks ago that modern liberal theology denies that God would “intervene” in nature by violating its regularities or laws. With chaos theory, we find that the regularities and laws of nature are such that the most minute and subtle actions on God’s part could generate enormous effects.

In a minute I’m going to tie this in with quantum physics. When you put chaos theory together with quantum mechanics, you can do away with “intervention” altogether, while still affirming that God “does stuff,” such as actively guiding creation to its appointed end. That is our first snap-shot. Recall that I said that where fundamentalists speak of God’s “action,” liberals speak of God’s “presence.” Here we begin to see that science is changing that to some extent.

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<sup>4</sup> Peacocke, *Paths*, 99–100.

## **The Design Argument**

For our next snapshot, we will look at chaos theory's bearing on the question: does God exist? Two weeks ago, I talked about the various types of arguments for God's existence, one of which is the argument for Design. Chaos theory is sometimes used in "organic" arguments for Design. The question, "Does God exist?" is answered "Probably, yes," because God's existence is found to be the best ultimate explanation we can find for certain tendencies we have indentified in nature. So goes the argument.

This is an especially "iffy" argument, because the science on which its based is in a state of flux.

[Those who make the argument are not limited to those who belong to the movement known as "Intelligent Design." And the argument won't work for all who belong to the movement known as "Theistic Evolution."]

the strength of the argument rests on the fact that the universe seems naturally to want to organize itself towards complexity and life. There is a Greek term making the rounds among molecular biologists to label that apparent tendency. The word is "autopoiesis," from *auto*, for "self," and "poiesis," which means "to make." Autopoiesis: "self-making."

The notion of autopoiesis has arisen over a bone of contention among evolutionary theorists. There is significant disagreement among evolutionists right now on the question of how much power natural selection really has.

Remember what I said about Darwin's theory of natural selection: it is an algorithm. Given variations between members of a species; and given that these variations are passed on through reproduction; and given a struggle for survival, then the result is evolution.

Some biologists have said that Darwin's algorithm is not sufficient to explain the full course of evolution, and have used the concept of autopoiesis and chaos theory to fill out a more complete and satisfactory explanation. Other biologists, including Richard Dawkins, disagree. Dawkins maintains that natural selection is a sufficient explanation for all the complexity and diversity in nature. Who is right? That is the scientific issue.

It is if Dawkins is wrong, and "autopoiesis is right, that the theological issue arises.

The theological issue is, which would make better sense of autopoiesis: the materialists' claim that ours is metaphysically a meaningless and purposeless existence, or the Jewish, Christian and Muslim belief that the world was created by a rational and loving God, to bring forth intelligent creatures who could know God and love him in return.

You will find this argument in Holmes Rolston's book, *Genes, Genesis and God: Values and Their Origins in Natural and Human History*.

Rolston says that autopoiesis itself requires an explanation: "Say if you like that there is a bias for self-organizing or autopoiesis in the process that explains the remarkable results. That may be good

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science, but now we are in a religious or metaphysical mode and need to explain this remarkable  
bias...”<sup>5</sup> (*Genes*, 298)

Rolston compares the Christian doctrine of creation against metaphysical materialism, and asks which worldview gives the more plausible account for the emergence of a stream of increasingly complex and meaningful values, as the history of evolution unfolds. Rolston makes the (scientific) claim that natural selection’s power to explain has reached its upper limit at the point where evolution gives rise to language and culture; and even shy of that limit, he contends, it is by no means clear that Darwin’s mechanism is sufficient to explain an evolutionary story that leads from a pre-biotic soup all the way to humankind. Even from the beginning, the whole story seems to have involved a suspicious amount of luck. It seems to be against all odds that a blind and self-interested process could have generated, for example, a scientific culture, and a mind like Darwin’s, capable of exposing the mystery of its own origin. “Perhaps this luck,” says Rolston, “is really a confession that one has no plausible causal, lawlike explanation of the mind’s origin.”<sup>6</sup> On Rolston’s reading, evolution is rich with luck of this sort, facts that are “hard to explain without some sort of generative principles before which many persons are inclined, one way or another, to become religious.”<sup>7</sup>

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<sup>5</sup> Holmes Rolston, III, *Genes, Genesis and God: Values and Their Origins in Natural and Human History* (Cambridge: Cambridge University Press, 1999), 298. Rolston cites: (Kauffman 1993; 1995; Maturana and Varela 1980)

<sup>6</sup>Holmes Rolston, III, *Genes, Genesis and God: Values and Their Origins in Natural and Human History* (Cambridge: Cambridge University Press, 1999), 207.

<sup>7</sup> *Ibid.*, 297.

And that is an organic argument for divine design.

It is a theological argument that hinges on a scientific question: how powerful is natural selection? In this instance, “Design” isn’t offered as a scientific alternative to natural selection. The scientific alternatives are: “Natural selection alone” and “natural selection + autopoiesis.” The metaphysical alternatives are: “Design,” “Many Universes,” and “Crazy Luck.” The question is: which of these three is the best explanation for natural selection + autopoiesis.

We will meet the same issue when we come to quantum physics, though there it will be a cosmic, rather than organic, argument for divine design.

## Free Will

Our third snapshot is of a connection some have seen between chaos theory and the theological claim that human beings have free will. I will tell you at the outset this argument is weak—but that’s not to say there is nothing to it. We could say it is important because it is a crack in determinism’s armor.

We have discussed the theological problems associated with modernity’s long-reigning belief in physical determinism—the theory that if we only knew all the relevant laws and information, we could in principle predict the future of the natural world. A predictable universe is a world where neither God nor human beings have room to decide and act.<sup>8</sup>

Judaism and Christianity are both strongly committed to belief that both God and human beings have room to act on their own volition. This freedom is implicit in the notion of a covenant—an agreement—between God and human beings. Covenants, as you know, are very important in the Bible. God makes one with Israel through Moses, then he makes a new one with all the world

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<sup>8</sup> Though Kant, we must note, offered a compatibilist account, affirming both physical determinism and human freedom. Kant’s anthropo-physical compatibilism is grounded on his distinction between two standpoints. From the standpoint of the sensible world (the world as it appears to us) the universe is considered deterministic. From the standpoint of the intelligible world (the world in itself), we act on the presupposition that we are free. Immanuel Kant, *Groundwork of the Metaphysic of Morals*, trans. and ed. H.J. Paton, rev. ed. (New York: Harper Torchbooks / Harper and Row, 1964), 114–116. We are following Paton’s analysis, 46–47; See also Wildman, “Divine Action Project,” 39, 58.

Week 5: God and the New Physics: Quantum Mechanics, Chaos Uncertainty and What They Mean through Jesus Christ. Baptism and Eucharist are both symbols of the new covenant, and our participation is our way of saying “yes.”

Virtually everything we say and do in church assumes that we are free. According to modern cosmology, this belief in freedom is a delusion.

Chaos theory doesn't challenge modern cosmology on that issue. It is consistent with a determinist cosmology.

What chaos theory does do is show that science can't predict the future. Modern cosmology had held that, because the world is deterministic, its future, in principle, could be predicted.

Speaking for an emerging consensus, John Polkinghorne, in *Faith of a Physicist*, does not hesitate to say that the modern view was wrong: “Most of what we have to deal with in macroscopic physics is intrinsically unpredictable.”<sup>9</sup>

Polkinghorne goes on to argue that this alone is reason enough to conclude that the world is also not deterministic. But most people, myself included, have not found this argument convincing. All we can say is that if the world were predictable it would be deterministic, and if the world is deterministic, then Christian belief in freedom isn't true. Chaos theory shows the world is not

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<sup>9</sup> John Polkinghorne, *The Faith of a Physicist: Reflections of a Bottom-up Thinker*, Fortress Press edition (Minneapolis: Fortress Press, 1996), 25.

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predictable. That is not saying much, but it is a start. From a Christian point of view, we are moving in the right direction.

So, in sum, our three snapshots: the science of chaos theory has shown this (1) to be a world that seems to have some in-built propensities for life, where (2) small causes produce big effects, and (3) whose future, as far as physics is concerned, must remain in some respects unknown. All this is moderately important and is certainly consistent with a Christian worldview. Now lets turn to quantum physics, where I think we can justify some somewhat stronger claims.

## Quantum Mechanics

What is it?

Quantum physics is a collection of discoveries concerning the underlying physical properties of the world and of certain limitations and paradoxes that come into play when we attempt to measure these properties, understand them, and predict what they are going to do.

Here for example is the Nobel-physicist Charles Townes, discussing the discovery of a paradox concerning the physical properties of light.

With the birth of quantum mechanics in the early part of this century, light took on aspects of both particles and waves. This duality is contrary to normal human intuition, and continues to be challenging. When we shine light on a glass window, some of it is reflected back while the rest passes through. Yet we should and can ask: How does an individual particle of light, a photon, decide whether to bounce back or to pass through? Attempting to answer such a question leads to the Heisenberg uncertainty principle. According to this, we can never know for certain which particular photon will pass through the glass or be reflected. A fundamental uncertainty pervades the full extent of our knowledge of the physical world. The best we can do is predict the odds—the probability—that a given thing will happen, or that a given photon pass through or be reflected.”<sup>10</sup>

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<sup>10</sup> Charles H. Townes, “Logic and Uncertainties in Science and Religion, in Peters, *Science and Theology*, 48.

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If chaos theory shows us that the future is unpredictable, quantum theory shows us that, even with regards to the here and now, there are just some things that we absolutely cannot know.

Werner Heisenberg was able to prove that we cannot simultaneously know the position and the momentum of an electron. To pin down its position requires losing track of its momentum—and vice-versa. That's called quantum uncertainty.

Recall that the cosmology of the early 20<sup>th</sup> century was:

- Atomistic
- Deterministic

It was atomistic, in that it saw matter as at bottom comprised of atoms—tiny, but discrete physical entities.

And it was physically deterministic, meaning that given that the world is one way at a given moment, its unfolding thereafter is fixed and inflexible.<sup>11</sup>

The prevailing view concerning chaos theory is that while it shows that the universe is unpredictable, it does not show the world is indeterministic.

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<sup>11</sup> It was also reductionistic, in assuming that if we knew everything there is to know about atoms, we would have a complete description of the world.

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But the prevailing view of quantum theory—called the “Copenhagen Interpretation,” is that it does show our universe to be indeterministic at its core.

This almost completely exhausts my knowledge of quantum theory.

### **Interest to Theologians**

Now what is interesting in this to theologians?

The connections, again, have to do with:

- (1) Divine action
- (2) The existence of God
- (3) Free Will

Most theologians would agree with me that with respect to these points quantum physics is significantly more important than chaos theory.

So, let us again take three snapshots.

## **Divine Action**

For our first snapshot, we return to the problem of divine action.

Again: the question is, how does God act?

A number of theologians are suggesting that that, in addition to acting in creating and sustaining the world, God may sometimes for special purposes act within the inherently unpredictable interactions that take place at the sub-atomic level.

The key scientific point is that the world is not made up of little, bouncing bb's. It isn't "atomistic."

If it were atomistic, and if God wanted to make a change—say, in answer to a starving widow's prayer for a successful harvest—then God would have to move one of those bb's in one direction or another, to create the desired physical effect—for example, to send rain to relieve a drought.

Those changes would violate the laws of nature and thus would constitute an intervention.

Again, liberal theologians don't believe in interventions, which has meant in the past that they also couldn't believe in miracles, and only with great difficulty in any kind of special acts of God. This has led to rather sweeping re-interpretations of the Bible, including of the healing miracles of Jesus, and of his resurrection. Generations of biblical scholars were guided by the axioms of the German scholar Ernst Troeltsch, who ruled out accepting miraculous reports as historically authentic. Those

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scholars presented a very different Jesus to the church. (As an aside, many have noticed that this new Jesus almost always seems to closely theologially and politically resemble the scholars who are presenting him.)

Our point today is that changes in science have re-opened some minds on certain historic questions.

Now it turns out that before matter becomes “particulate,” it exists as a range of undetermined possibilities. Were God to select a specific possibility from among the available alternatives, that is not thought to constitute an intervention.

And if you take the non-interventionist possibilities for special divine action in quantum mechanics, and combine that with the potential amplifying effect of self-organizing systems, then if you are a liberal theologian you have room to reclaim a somewhat more robust understanding of God’s involvement in creation.

## Miracles

So Quantum theory and chaos theory have allowed some theologians to maintain that the physical world is built so as to leave room for miracles. These are not understood as interruptions of the laws of nature, because at the quantum level there are no laws to interrupt. But miracles are expressions of a higher law—the law of God’s moral purposes, and a foretaste of the completion of those purposes in the fulfillment of his Kingdom.

Keith Ward takes that position, representing the rise of a different kind of theological liberalism than we used to see in Paul Tillich and Rudolf Bultmann. Ward is a noninterventionist; he does not regard miracles as acts by which God would “interfere” with nature. Rather, he says, “it is more a matter of working with the realisation of natural powers.”<sup>12</sup> Miracles, he says, are “specific acts in which the normal physical powers of objects are transcended . . . manifesting in an extraordinary way in the physical realm the underlying spiritual basis and ultimate purpose of the cosmos.”<sup>13</sup>

Remember when I talked about John Henry Newman’s principle of “antecedent probability? It means that when you start with belief in a beautiful, intelligent and loving God—and that is the view of God we have in Christ—then that predisposes us to accept that certain other things are likely true.

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<sup>12</sup> Ward, *Pascal's Fire*, 214.

<sup>13</sup> *Ibid.*, 230–31. And with the definition, comes this warning, that “it is wise to be cautious in accepting testimony to the occurrence of miracles.”

In his book, *Religion and Revelation*, Ward appeals to a principle of antecedent probability against the notion that a critical reading of the Bible should rule out an interpretation of Jesus' miraculous acts as historical events. Ward declines to accept Ernst Troeltsch's rules for historical-critical investigation of Scripture, which had in effect placed a literal interpretation of the miraculous beyond the pale of scholarly consideration. Ward rejects Troeltsch's axioms. He regards them as an example of the way materialist presuppositions penetrate Christian thinking, so that they "begin to undermine the Christian witness to the Lordship of Christ."<sup>14</sup> In *Pascal's Fire*, Ward aims to show that "miracles are possible and even rather likely, if there is a God." Indeed, one might well expect that God would "act in extraordinary ways to reveal the divine nature and purpose;"<sup>15</sup> so Ward argues, against Troeltsch and many others, for a "principle of trust" as the presupposition we should bring when reading Scripture.<sup>16</sup>

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<sup>14</sup> Ward, *Revelation*, 256.

<sup>15</sup> Ward, *Pascal's Fire*, 217.

<sup>16</sup> Ward, *Revelation*, 256. Ward is by no means suggesting that every biblically reported miracle happened, or that all should be interpreted in a literal sense. He does, though, state that some of them must be accepted as such, including especially the resurrection, or else Christian belief is undermined. See page 252 in the same book, where Ward writes: "It is only if the resurrection is actual that the life of a crucified man can show, not just that self-sacrifice has a certain tragic useless nobility, but that Being itself is to be trusted, since death, however cruel, is not the end."

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Thus have quantum mechanics and chaos theory opened a door for liberal Christianity to begin moving back towards a less equivocal theological position.

I will slip in this comment: it may be that the Intelligent Design movement has made it more safe for evangelical and fundamentalist Christians to move away from stubbornly literalistic biblical interpretations, back toward a theology more consistent with mainstream science.

If liberals can also be seen migrating back towards a theology more consistent with the mainstream of Christian theological tradition, then we may be witnessing a significant narrowing of the fundamentalist-liberal divide.

I hope that's true. It would be a good thing, in my opinion.

## **Free Will**

In Week One I said Christianity had encountered challenges from the modern worldview, including especially its cosmology.

Again:

According to modern cosmology, the universe is composed of tiny particles of matter: atoms. It was believed that those atoms move only in strictest accordance to “natural laws,” and if only we could know where all the atoms were, and with what momentum they were moving, we could know the future. The future is already determined. Because humans are included in this deterministic picture, our sense that we have free will is an illusion.

And again:

To the extent that modern science would bind itself to that cosmology, and that Christianity would maintain belief in free will, modern science and Christian belief were actually incompatible.

Belief in free will comes early in the Bible, when Adam and Eve disobey God and eat from the tree of knowledge of good and evil. It is there when Moses at the end of his life gathers Israel and declares “I call heaven and earth to witness against you this day, that I have set before you life and

Week 5: God and the New Physics: Quantum Mechanics, Chaos Uncertainty and What They Mean death, blessing and curse; therefore choose life, that you and your descendants may live.”<sup>17</sup> It is there in the acceptance by some, and refusal by others, of Jesus’ message.

It is also an article of Christian faith that God is free to respond to our choices, and our love and faith, to heal and to protect and to bless. Freedom is a two way street.

So there was indeed a conflict between modern cosmology and traditional Christianity in this very important respect.

For Christianity to be right, something about modern science had to be wrong.

As Stephen Barr writes:

“This issue of determinism and free will is one of the few where scientific theories have the potential of being in clear contradiction to religious doctrine; and such a contradiction really seemed to exist at the end of the nineteenth century. All that had been learned about the physical world in the preceding three centuries pointed in the same direction—toward deterministic laws of nature, while the religious believer was in the uncomfortable position of having to argue, against all scientific theory, that somewhere along the line determinism would fail.

The amazing thing is that it did fail. Completely against the expectations of the entire scientific world determinism was overthrown in the 1920’s by quantum theory.”<sup>18</sup>

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<sup>17</sup> Deuteronomy 30:19-20.

<sup>18</sup> Barr, 176.

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Do you remember T.H. Huxley and the strangled snakes of Hercules? Huxley, Darwin's advocate, bragged that extinguished theologians lay about the cradle of every science, like strangled snakes beside the crib of Hercules.

It turns out that theological affirmation of free will was one snake that proved too much even for T.H. Huxley's scientific Hercules. And that was a good thing for Hercules, because snakes, as you know are often very beneficial. Up in north Arkansas, where I grew up, people knew that a good King Snake keeps down the rats and copperheads.

[Try to imagine a society that had rid itself of the idea that humans are free creatures who must accept a degree of responsibility for their own actions. That is difficult to do, But Clarence Darrow, the Scopes lawyer, gave us a glimpse with his defense of the young murderers Leopold and Loeb. They killed for fun, and Darrow's defense was that they didn't have a choice.

## **“Proof” of God’s existence**

*Question.* Now what might quantum mechanics have to do with arguments for the existence of God?

*Answer.* The quantum nature of the universe is one more “anthropic coincidence” to include in the cosmic argument for divine design.

Let’s think for a minute about the word “quantum.” A “quantum” is a particular amount of something.

In classical physics, atoms were understood on the model of miniature solar systems, with electrons orbiting the nucleus like so many planets orbiting the sun.

On that model, it would seem to us that any orbit should be possible, just as a planet could be a little closer or a little farther from the sun.

But according to quantum mechanics, with electrons that isn’t how it is. They orbit only at certain positions that are all multiples of number known as “Planck’s Constant,” named for the physicist who discovered this, Max Planck. It is as though a planet could orbit the sun at a distance of a 100 million miles, or 200 million, but not at 150 million or any other point in between.

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(If you are interested in this, I recommend the Teaching Company Lecture Series, “Einstein’s Relativity and the Quantum Revolution: Modern Physics for Non-scientists,” by Richard Wolfson, Ph.D.)

According to Stephen Barr, quantum physics means there is a certain “graininess” to the universe, comparable to the graininess in a color photograph in a magazine. When you first look at it, it “appears to be a very accurate image of the object it is supposed to represent. However, if it is examined very minutely, the magazine picture can be seen to be made up of many tiny, colored dots.”<sup>19</sup>

Quantum physics is that closer look. According to classical physics, the fabric of the universe was smooth. However, this left classical physicists puzzled in one very important respect. According to their calculations based on their well-established laws of physics, atoms should collapse. One of the first arguments made for quantum mechanics was that it could account for the obvious fact that atoms aren’t collapsing like classical physics said they should.

This is Stephen Barr:

“The graininess of energy in the world saves us from an ultimate catastrophe: the collapse of matter. The point is, if an atom were described by the laws of classical physics, then each electron in the atom would lose energy continuously as it orbited around the nucleus. It would lose this energy by

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<sup>19</sup> Barr, *Modern Physics and Ancient Faith*, 135.

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'radiating' electromagnetic waves—that is, light. As it lost energy, it would spiral in closer and closer to the nucleus, until finally it came to rest at the nucleus's center. The whole process would take less than a billionth of a second. Atoms would collapse. Even atomic nuclei would collapse. In fact, all matter would collapse to infinite density.

However, in our quantum world, this collapse cannot happen.”<sup>20</sup>

So here again science uncovers a surprising fact about the world. If the physical properties of the world were slightly different than they are, we couldn't be here to talk about them. That brings us back to two weeks ago, and the logic of abduction.

Let us say that what Paul says in his letter to the Colossians is true: in Christ “all things were created, in heaven and on earth . . . all things were created through him and for him, and in him all things hold together.”<sup>21</sup> If that is true, then the fact that the world is endowed with the graininess it needs for people like you and me to wake up on a Sunday morning, have a cup of coffee, a look at the paper, and come to Church, would only be expected.

Thus, according to the logic of abduction, there is that much reason to believe that what Paul says is true—that is, in the absence of any equally or more compelling alternative.

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<sup>20</sup> Barr, 135.

<sup>21</sup> Colossians 1:15-17

Week 5: God and the New Physics: Quantum Mechanics, Chaos Uncertainty and What They Mean

Now we need to be careful not to make Galileo's mistake of claiming more than his logic would support. Of course one can conceive of other hypotheses that would explain the quantum nature of the world. As arguments for God's existence go, this one is very modest.

But all these modest little arguments make up the fabric of reasonableness in faith. I hope that by now you realize that when we talk about the reasonableness of faith we are not comparing it directly to the reasonableness of science. That would be like comparing an apple to an . . . apple tree.

We are not comparing the reasonableness of science and faith. We are comparing the reasonableness of faith with the reasonableness of unbelief. And we are asking, in that metaphysical comparison, is it faith or unbelief that finds the better fit with science? More and more it seems to me that, in this comparison, it is faith that holds the higher ground.

Next week: "The Soul and its Future: Neuroscience, Free Will, and Resurrection."

## **At the End**

Again, these housekeeping points.

- (1) I hope you were able to find last week's lecture notes. They are not, I repeat not, on the itssm.org website. We have a new site under construction that will be able to handle posting notes and whatnot, but it won't be ready until the class next spring.
- (2) If you would like to be kept abreast of future offerings, including next spring's class, please sign in with your email address on the sheets I am passing around. It would help if you could give me the sheets you are holding in your hand at the end of the class.
- (3) At the end, as we approach time for the service, if we could continue discussion in the Welcome center, that would allow people coming in for worship to settle in and say their prayers with a little peace and quiet.