Fuller Theological Seminary

Divine Action in the Context of Modern Scientific Thinking

Paper for the Class

PH870: Advanced Science and Theology Seminar

Winter 1997

by

Christoph Lameter

March 21st, 1997

v

Table of Contents:

I. Introduction

How can God interact with us and with the world? The problem of how God can do something - *divine action* - in this world is very important for Christians today. Without a proper account of God's action we will not have a credible defense of a God who is actually able to do something and we will not have the God who is described in Scripture for example. God is not only the creator and sustainer of all natural processes but is also able to interact with humans through revelation and other divine acts.

The current popular opinion is that science has discovered the laws of the universe and it is assumed that everything is determined by those laws. Something undetermined simply leads to the assumption that the law governing the process has not been discovered yet.[1]

It is often customary in theology to avoid a direct explanation of how God can act within the framework of science which describes our available knowledge of the basic building blocks of our universe. Religion is said to have another language to speak about the same realities which are also described by the natural sciences. They are complementary and this complementarity is understood as two distinct not directly comparable realms of understanding (Dyrness p.132-133). Complementarity essentially isolates both realms avoiding fruitful interaction between those fields of study.

I would content that this approach is not consistent with the Christian tradition. Christianity started initially by building on an early Jewish/Hebrew understanding of God transforming that understanding and culture and getting its first adherents from that culture. Later Christianity used the prevalent thinking in the Greco-Roman culture to express its message and again transformed that culture. Similarly today we cannot continue to insist on our own frame of reference in dialogue with the secular world. We need to use the cultural thinking of our contemporary time period to express Christian core beliefs. Thinking is largely dominated by science today and it is therefore logical to utilize the best science today to communicate and express core Christian concepts. If Christianity really is the superior paradigm then it will be able to be expressed in inferior limited systems (such as the natural sciences) and add to the explanatory power of those systems by transforming them.[2]

This paper will try to show how divine action is possible within the framework of (post)modern science. Note though that there is more to God than just causation where the focus is here. God is a person and one of the desired outcomes of a scientific model of divine causation is the possibility for God to act as a personal agent.[3]

The paper here largely builds on work done by Nancey Murphy, John Polkinghorne and Bob Russell on divine action and presents a possible way of integrating science and theology through a common model of causation.

---

[1] See Stephen Hawking *Black Holes and Baby Universes* the chapter *Is everything determined?*.

[2] See Alaisdair MacIntyre *Three Rival Versions of Moral Enquiry* Notre Dame, 1990 for a discussions how traditions (or paradigms) compete.

[3] Jewett *God Creation and Revelation* p. 355-356

II. Concepts from Science

In order to discuss how divine action may be possible we need to investigate some more recent developments in our scientific knowledge. The issues discussed here are usually not widely known but are important for the following discussion.

A. Quantum Theory

Quantum Theory has been developed for over sixty years now but the interpretation of what it exactly means is still hotly disputed (Polkinghorne ix). Quantum Theory describes characteristics of the most fundamental building blocks of our universe. At the beginning of the 20th century both particle and wave behavior was being observed of the smallest building blocks of matter known at the time such as for example an electron. The following discussion is based on the famous two slit experiment which is the classic way to show the basic characteristics[4].

Quantum Theory got its name from the discovery that energy is not arbitrarily dividable but comes in a number of undividable packages (=Quanta) of energy. These basic energy packages were identified with particles later. A certain energy potential is a fundamental characteristic of each particle. When we look at the smallest level of reality known to us reality is losing its smoothness and becomes chunky.

The experiment consists of three elements. First there is a source for particles. To make things more concrete we have build into our experiment here an electron gun. The second part is a screen with two holes which are small relative to the wavelength of the electron. Finally there is a detector screen which will show a flash whenever an electron impacts on it. The detector screen is a means of recording where an electron went after it has passed through the holes.

Note that parts of the following discussion will sound incredible but these are actual experimental results that have been verified again and again. The basic content of this paper was presented in class with a professor of physics being present confirming what was said.[5] The behavior mentioned here has not only been verified for electrons but also for photons.

When the electron gun is sending electrons through this setup an interference pattern can be seen on the detector screen. The holes in the slit screen act as a source for waves interfering with each other producing the pattern on the detector screen.

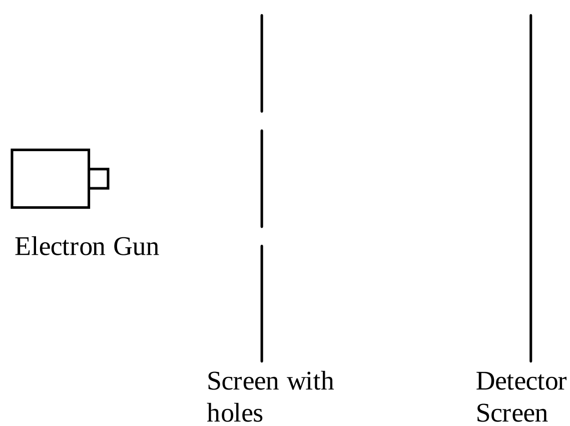

Figure 1: Classic Experiment to show basic characteristics of Quantum Mechanics

The electrons behave both as particles -- they are emitted from the electron gun and are causing a flash on the detector screen on impact -- and as wavelike entities interfering with each

[4] The discussion here is partially indebted to Polkinghorne (1984) and Gribbin (1986).
[5] Further readings may be found in the Bibliography by Polkinghorne 1984

other producing the pattern. The dual wave-particle nature is one of the most difficult things to understand about Quantum mechanics.

If there is only one hole in the screen then no pattern will result on the detector screen but instead a bright spot can be seen. Only when two (or more) holes are open will a interference pattern be produced which shows the wavelike characteristics of the electrons.

So far this is still easy to visualize as for example like a wave in the water. Water consists of molecules and a great number of molecules together produce the impression of a wave at sea. If there are zillions of electrons being fired through the apparatus simultaneously then the result is not that surprising.

But now the electron gun is restricted to firing one electron at a time. Remember that each particle has a certain energy associated with it. We can tune the electron gun to just emit energy bursts of that size and so guarantee that only one electron is emitted at one time. We expect that there would be no pattern anymore since the one electron has no other particles to interfere with. But when firing one electron after the other it can be observed that the electrons cause flashes on the detector screen in exactly the same pattern as if they would still be interfering with other electrons. Are they interfering with themselves or do they remember the path taken by earlier electrons to the detector screen? Both explanations are implausible.

The most plausible explanation might be that one electron is going through both holes at the same time and then is interfering with itself. We want to know for sure now what kind of tricks the electron is playing with us and so we equip both holes with detectors to light up when an electron passes through them. And surely enough when single electrons are fired one time the one hole is taken and another time the other hole is taken and the corresponding light comes up. There is no reason known to us why the electron would take one hole or the other. It just seems to arbitrarily pick one. More mystery! The behavior of the electron is not deterministic since we cannot say through which hole it will pass. Thinking back what happened when the single electrons shot at the apparatus was building a pattern on the detector screen we also have to conclude that non-deterministic behavior was already observable at that point. The electron did not always hit the same spot on the screen but varied the location hit according to a pattern of probabilities producing the pattern.

Back to the situation when we have additional detectors on both holes and have the electron arbitrarily pick a hole to pass through: Now we take another look at the detector screen and see that the interference pattern is suddenly gone. Switching the electron gun back into firing lots of electrons at the same time we see no pattern anymore on the detector screen but only two white spots. Our attempt to detect the electron has changed the whole dynamic of what is going on and the interference pattern generated by the wavelike characteristics of the electron has vanished. Did the electron loose its wavelike capabilities by measuring it? The electron seems to have adapted to our expectations. We wanted to detect a particle at the holes in the screen and so the electrons gave up their wavelike characteristics and satisfied us by behaving completely like particles. But dare we switch those detectors off! Then they will be back to wavelike behavior. It seems that the particle knows when we are looking and is friendly in fulfilling our expectations!

It gets even weirder when we just switch on detection of the electron only on one of the two holes. Then the electron will always pass through the hole with the detector on it. The electron does not pick a hole anymore but does what we expect of it.

Detection of an electron makes the wavelike characteristics disappear. The “wave function collapses” (technical term).

1. Indeterminacy

A *wave function* was just mentioned. Such a function is used to describe the **probability** that a particle can be detected at a certain location. Remember that the electron in the experiment arbitrarily picked one of the two holes to pass through. Particle behavior is determined always by probabilities. The wave function describes the probability of the particle to be detected anywhere in the whole universe!

The basic known elements of our world are *not* known to behave in a predictable way but only according to chance and probabilities. This is a very important fact to keep in mind.

2. Non-Locality

Looking back at the experiment we see that the wavelike characteristics of the particle enable it to do some strange wizardry. One electron is able to simultaneously go through two holes at the same time and interfere with itself although no other electron is present. This means that the particle does not have a fixed location in space but it is (sort of) spread out over all the locations where it could potentially be. The particles only have a definite location when measured by some sort of device or when interacting with something that requires particle like characteristics like the detector screen.

The wave function describe the possibility of a particle to be detected anywhere in the universe and as we have seen there is interaction going on over all potential locations of the wave function during the interference. The particle therefore has the potentiality of interacting with anything else located somewhere in the universe (although the probability might be exceedingly low). This means that any particle can interact with any other particle. This fact alone should be enough to give up all dreams of ever being able to compute future events in an accurate way through known laws (discussed later in detail). In some sense the particle is omnipresent like God is in the universe.

3. The Observer

Classical science assumes an independent observer taking measurements. Quantum Mechanics does not allow such a concept. All interaction influences the things observed as seen in the experiment and taking measurements is such an interaction which can lead to a complete change in the nature of the experiment as seen in our example. Quantum behavior cannot be observed by a neutral observer. At some points observations can be made but there is no way of knowing what happened in between observations and the observation itself will influence what is being observed. We cannot say through which hole the electron has passed that hit the screen. If we would be able to do so then the experiment would no longer be the same.

4. Uncertainty

Heisenberg found another fundamental element of quantum mechanics the *Uncertainty Principle*. Uncertainty says that it is impossible to measure a particle accurately. Accuracy of measurement of one characteristic always leads to restrictions of the ability to measure other important characteristics of the particle. This of course is only true in relation to the very fine measurements required when observing particles. The product of the uncertainty of two complementary characteristics of a particle is always greater than a certain constant. Two important examples of complementary characteristics are **location / speed** and **time / energy**. If the location of a particle is very accurately known then the speed with which it is moving cannot be known accurately and so the location where the particle will pop up next can only be known with a large amount of uncertainty. If the speed of the particle is measured then we cannot know exactly where it is. If (theoretically) we would know the location of a particle with absolute precision then the speed of movement would be totally unknown and the particle would have the potentiality of popping up anywhere.

At the smallest level known to us accurate measurements are not possible and we are at the boundary of what we can measure and therefore at the boundary of what we might be able to know.

5. Tunneling

The uncertainty in energy of particles gives rise to interesting phenomena. A particle might not have sufficient energy to escape for example from an atom. But through energy uncertainty it might suddenly act as if it would have so much energy, go over the barrier and immediately return the energy borrowed and continue on its way. The implication here is that a particle cannot be confined to a certain space indefinitely. There is always the uncertainty that the particle will suddenly gain enough energy to pass through all barriers and escape the location in which it was to be contained.

It looks as if a quantum particle is able to dig a tunnel through barriers and escape.

6. Virtual Particles

Uncertainty also means that particles can suddenly come into existence if there is enough energy available. Energy uncertainty increases as we reduce the time of observation. Particles come into existence as a pair: particle and antiparticle. Virtual particles are indistinguishable from real particles and will usually only be distinguished by their short lifetime.

B. Chaos Theory

Another recent development in science is Chaos Theory. Chaos Theory describes systems in which any small difference in the initial conditions can be amplified in such a way that arbitrary huge differences in the later development of a Chaotic system result (Blackburn

p. 61). Chaotic systems develop quickly in such a way that makes it impossible for us to predict the next event in the chaotic systems. Models for Chaos Theory are developed from a simple inductive sequence:

Logistic Function: $x_{n+1}=k\ x_n(1-x_n)$

For some ranges of the values for k the generated sequence is developing very fast into an apparent random nature of values. The values are highly depending on the initial condition x_0. Slight variations in the value of x_0 will lead to wide diverging values of the later development of numbers in the sequence. Calculations of the numbering sequence quickly begins to require precision of calculation beyond all our theoretical abilities of computing through mechanical means or calculus.

In Chaos Theory we have simple rules governing a system. We know everything about how the system is developed since there is a simple rule for the production of the system. But despite our full knowledge about the chaotic system it is still unpredictable in the long run. We have a system here of which we know the initial condition x_0 and the rules governing the development which would lead us to assume that this is a classical deterministic system. In some sense we have a deterministic system that is unpredictable.

The theoretical Chaotic systems discussed in Chaos Theory show a high sensitivity to initial conditions. Every intermediate value x_i can potentially also be taken as the initial condition of another chaotic system. Thus chaotic systems are highly sensitive not only to initial conditions but also to influences from outside the system that might modify the resulting values x_i.

So far we only looked at models for chaotic systems. In reality it is impossible to accurately measure initial conditions due to Heisenberg’s Uncertainty Principle. Uncertainty also affects all intermediate values x_i and thus the predictability of the logistic functions is extremely limited in practice. The chaos systems discussed in Chaos Theory have to be taken as models that can be used to highlight certain aspects of nature but their applicability to reality is severely limited and thus also the theoretical use of Chaos Theory has to take that limitation into consideration.

It is inaccurate to see chaotic systems in reality as deterministic since there are constant quantum fluctuations within natural processes influencing intermediate states. Chaos is only deterministic as a mathematical model not in reality. The distinction between unpredictability and indeterminacy made by chaos theorists is an academic distinction with no relevance for real systems.[6]

Chaotic systems are useful in showing that slight variations in conditions can be amplified by natural systems beyond all measure and that a system set up with conventional means to be deterministic can turn out not to be predictable in the long run.

[6] For a different discussion see Murphy p. 327 in Russel, Murphy and Peacocke 1995

C. The nature of the "Laws of Nature"

In the past the "Laws of nature" have had a kind of divine status. They were always true, proven, not violable and governing the behavior of all matter. It was assumed that those laws had a reality of their own.

The picture emerging from our knowledge of the basic building blocks of our universe is quite different. Physical laws like for example the laws of motion do not deal with individual particles but with a very large number of those particles composing matter known to us. But still the behavior of those particles is governed by probability. In such a huge number as needed to compose matter we are dealing with in our everyday life all those probabilities combine resulting in highly reliable behavior of the world around us. But combining probabilities can never make an event certain. The probability can increase and approximate 100% but can never reach 100%. For practical purposes the certainty can be assumed but from theory we know that this is impossible.

The laws of nature have therefore a statistical nature. They are useful because matter usually behaves in the way we observed in the past and therefore those laws have a purpose in allowing us to project what will happen in the future. But there is a slight chance in all those probabilities that one day something else will happen. Those laws do not have the ontological status that was given to them in the past.

The development of scientific knowledge also supports this point of view. After Newton proposed the laws of motion there was optimism that the eternal laws of the universe are now known. Later Einstein showed that Newton's laws of motion are just a special case of a more universal law. Newton's laws are only valid when matter moves with slow speed relative to the speed of light.

It is a general feature that side conditions necessary to make the known scientific laws work are not completely known. Laws might have to be revised when matter behaves in a different way due to circumstances not considered before .

One might object then why do science if we cannot find eternal universally valid laws? No such belief in the ontological status of "Laws of Nature" is necessary to do science. What is necessary is the recognition of observable regularities in the world that allow a prediction of aspects of future events in certain circumstances (Murphy p. 337 in Russell, Murphy and Peacocke 1995). Those regularities are described in a variety of ways used by humans to communicate about these regularities and limited by the use of those humanly understandable languages[7].

Another note at the side: When classic laws of science are applied to the quantum world they become problematic because the classic laws assume a smooth universe with energy, positions of matter and speed quantifiable in an arbitrary way. Quantum mechanics has shown that the basic nature of the universe is chunky. A particle can only take a certain amount of energy and can only be observed within certain limits. Nature on the micro level becomes jumpy because energy can only be exchanged in certain quantities (Quanta). Nature becomes unpredictable due to uncertainty. There are quantum fluctuations

[7] Further details on the limits of formal systems can be found in my paper *On the Limits of Formal Systems.*

disturbing all attempts at a classical description of regularities. The smoothing effect of combining probabilities is lost the smaller the number of particles we observe becomes and classic laws of physics become more and more difficult to apply showing clearly the probabilistic nature of the prior known scientific laws.

III. God's action

The indeterminacy and other strange characteristics at the quantum level need to be accepted as the basic nature of the world. There our common notion of causality breaks down. A few scientists such as Stephen Hawking do not accept the inevitable limitation of our knowledge and are still insisting that the non-determinism of quantum mechanics is due to our lack of knowledge about the quantum world. Yet quantum mechanics has been challenged again and again with no one having been able to shake the foundations of the theory. Hawking still assumes a world completely determined by laws of nature that might not be perfectly known yet. The laws seem to have an ontological status for him. But he is unable to account for the human freedom based on his metaphysical commitment to those laws (Hawking 1993 Chapter 12 *Is everything determined*?). His position makes it impossible to understand and explain one of the basic human characteristics that we are all aware of.

So I propose to take the indeterminacy at the quantum level as an ontological characteristic of the world which a majority of scientists today is also accepting. This move is one of the most important to be made on our way to an integration between science and theology and has far reaching consequences. A part of those will be discussed later.

I propose that God acts in the world through determining the indeterminacy's at the quantum level. God is acting on that ontologically un-determined level.

A single quantum event does not have much influence. To have a real effect on the macro level many quantum events must be orchestrated at once or some quantum influence might be amplified by the chaotic systems in nature.

But I would also propose that true indeterminacy at the Quantum level exists which is not influenced by God. This allows for the autonomy of nature and thus for freedom (with Tracy p. 321 in Russell, Murphy and Peacocke 1995) and is an interventionist scheme allowing a distinction between God not acting or God intervening. The distinction is necessary to speak meaningfully of God's acts.

I would like to call this way of God's interaction with the world **quantum causation** being aware that the term "causation" is not to be understood in the common way as causation by physical forces known to us but rather as a special kind of causation outside of what is knowable of the physical realm.

Quantum events seem to have partially divine characteristics. In some sense a particle in a wavelike state is omnipresent since it has the potential ability to interact with almost anything in the universe. It also is not localizable but has a distributed presence that is only fixed under certain circumstances. Quantum characteristics include behavior that is undetermined and thus random which could be interpreted as personal agency. Quantum behavior seems to be a bridge to the divine realm.

IV. Benefits

A. Distinction of God's intervention

The Christian tradition is full of stories where God is performing special acts that are outside of the customary expected flow of events. The proposed theory of quantum causation can distinguish in theory between events originated by God and regular events due to the ordinary behavior of matter. The distinction has commonly been made by Christians of all times and here we have a meaningful link of traditional language to physical events. It is granted though that the distinction is purely theoretical. No one can in practice decide if this or that quantum event was extraordinary or just a regular one. It might be possible though to decide on a higher level that a collection of quantum events was God's work. The most obvious is a miraculous healing of a person.

B. Top-Down causation

I contend that Top-Down causation is impossible in a totally deterministic universe. For Top-Down causation to be feasible there must be flexibility at a lower level to allow for the expression of higher level phenomena through a collection of lower level characteristics. Top-Down causation is only possible through an simultaneous Bottom-Up mechanism. Quantum-Causation provides such a framework and enables a proper understanding of Top-Down causation. It provides an open framework which Top-Down causality needs to operate. Top-down causality depends on gaps at the basic level (Polkinghorne p. 22 in Russell, Murphy, Peacocke 1995).

Top-Down causation works by an orchestration of a large scale of lower level events in order to have upper level phenomena emerge from the lover level events.

C. God is not only the cause

Paul Jewett criticizes common conceptions of God as the totality of natural causes. God as the creator of the world and the (inviolable) laws governing the world is a God imprisoned in his own created system unable to act. There must be a distinction of the autonomous characteristics of the world from the divine agency to make God a person that can be known and not some abstract principle governing the world (Jewett 1991 355-357). The proposal here makes God both the creator of the world and its regularities but also allows for God's personal agency in this world and for the possibility of experience of that agency. God is not only natural causation. Quantum causation is providing a framework for the personal agency of God.

D. Explanatory power

Quantum-Causation has a vastly superior explanatory power than the common notion of "chance". Chance does by its very nature explain nothing, simply lists possibilities without giving any reason for their choice. Chance is a statement of our ignorance. We do not know the reason. “Chance” does not allow us to predict anything (Murphy and Ellis 1996 59).

Quantum-Causation in contrast has explanatory power. It generates a view of an open universe that is designed and partially independent of the one who created it, and with that independence freedom for ourselves to act within a framework which is predictable for us is generated. We can act responsibly in such a framework because we are able to discern what kind of consequences our action will have. On the other hand it explains how God can intervene in the world. But it simultaneously highlights the risk of the predictable framework to be destroyed by too much intervention.

In some sense confirmation is generated in other areas of life for this view. The freedom of choice that we experience can be explained. The design of the universe becomes a purpose and thus chance is no longer chance but has a purpose.

E. Divine revelation

If God can act in reality through coordinating large amounts of quantum events for a purpose at a higher level then it is possible to assume that the same can be done with the human brain. God can effectively communicate with humans by direct stimulation of neurons in the human brain generating images and memories. God is able to communicate with humans in a direct way. May this be an explanation for the working of the Holy Spirit? Visions and other religious experiences could be understood through this process (Murphy and Ellis 1996 215, Murphy p. 349 in Russell, Murphy and Peacocke 1995).

V. Problems

A. Interventionism

An argument against interventionism was often made: God cannot create the world and set up the laws according to which it functions and then violate those laws. God would be inconsistent.

I think there is a wrong conception of physical laws at the core of the argument here. Quantum mechanics -- as described earlier -- shows clearly that laws are probabilistic and not inviolable. God did not create the laws of physics as we often assume but those laws are based on our current knowledge and are approximations based on our specific experience and view of the matter. The laws break down especially when used in the chunky micro world of quantum particles. The physical “laws” according to this understanding are not inviolable and therefore there is no contradiction with God intervening in a way that violates regularities we otherwise observe.

It has to be understood that divine action at the quantum level has the potential of violating our expectation of the regularities of the universe as encoded in our scientific knowledge. Nancy Murphy’s example of the Billiard Ball that moves without outside force is a violation of an idealized view of the “Laws of nature”. Quantum Causation is interventionist to the core (Murphy p. 346 in Russell, Murphy and Peacocke 1995) but it does not violate what we know about the physical world and its potentiality. It is in harmony with our current scientific knowledge about the world.

B. Macroeffects of Quantum Indeterminacy

It has been argued that effects of quantum indeterminacy do not have an effect on the macro world (our everyday life) since the effects cancel themselves out. There are two responses that can be given to such an argument:

I. Effects on the macro world result through the orchestration of large quantities of quantum events. It is *not* a single quantum event that causes effects in the macro world. Such macro effects are extremely unlikely and thus not reproducible in scientific experiments. Freak incidences occur in laboratories but they are usually discarded as something gone wrong. Science looks for the ordinary repeatable and not for extraordinary events. But our theoretical knowledge of the quantum world allows us to see the potentiality for extraordinary events.

II. Chaotic systems are influenced by quantum fluctuations which amplify the effect so that something becomes visible on the macro level (Russell, Murphy and Peacocke 1995 43). In order not to disturb the regularities in the world too much this might be the preferred way of God influencing the world since only a small amount of quantum events actually have to be influenced to cause a big effect.

C. This is a Gap-Theory

The theory of divine intervention here is based on gaps in the natural order to be determined by an outside agent such as God. The fact that this is a real causal gap in nature is acknowledged by many scientists such as Werner Heisenberg himself, the one who discovered the Uncertainty Principle (Tracy p. 291 in Russell, Murphy and Peacocke 1995).

Theologians are afraid of attaching God's intervention to explanatory gaps in the causality of science because the experience was made in the past that science found explanations for those explanatory gaps thus reducing the role of God and showing the foolishness of the Theologians.

It has been widely acknowledged though that this gap (quantum indeterminacy) in causality is an ontological one that cannot be closed. If this is the case then theology needs to have an explanation for the existence of such a gap and not shy back from contributing to the explanation of the gap. Quantum-Causation provides such an explanation.

D. Input of Information?

Wim Drees claims that Quantum Causation is incompatible with quantum physics because information needs energy to be transmitted (Drees p. 26 in Russell, Murphy and Peacocke 1995). Possible responses are:

I. Indeterminacy means there is no outside energy or force that causes a "decision" what the particle does. The determination of quantum can be seen from originating somewhere else outside of the realm of natural forces which is what we want. If there would be a physical force causing the determination of the quantum event then we would be able to trace that force and then quantum events would not be indeterminate.

II. Even if energy would flow: The commonly known Quantum-Tunnel effect shows that the particles can compensate/borrow/return energy on a temporary basis from Uncertainty. Energy from uncertainty could be used as a basis for an information transfer.

Wim Drees criticizes Polkinghorne for his example of a bead at the top of an inverted U-shaped wire for his assumption that the bead would move to the left or right without energy. Wim Drees is right in that there is energy necessary to move to either side. But the energy needed might be extremely small (given a sufficiently tuned instable system) so that quantum effects or quantum uncertainty can result in a slight movement and thereby an energy input causing the bead to move to one side or the other causing a choice to be made for one side over the other (See also Polkinghorne's example of atoms wiggling when viewed through an electron microscope due to quantum uncertainty) (Drees p. 226 in Russell, Murphy and Peacocke 1995).

E. God is playing dice?

The charge leveled (supposedly) by Einstein against indeterminacy was that "God does not play dice". It cannot be true and violates all principles of science that events do not have a reason but are without a detectable scientific explanation. I would take the randomness as an inherent characteristic of particles in question. God has given the world autonomy to generate freedom for his creatures and therefore the particles have the ability to play dice on their own. If God would be playing dice then God would be arbitrary and not a benevolent God. It is in sync with a benevolent God to create something and give it the freedom to act on its own.

F. Indeterminacy might be resolved

There are of course any number of interpretations of quantum phenomena possible. One such interpretation was presented here. None of those interpretations can be proven without the solution of indeterminacy itself since the crux of the matter is that there is no reason at all for indeterminacy. Quantum indeterminacy has been very slow to gain acceptance and was thoroughly questioned by the best minds such as Albert Einstein himself who found the whole idea very offending and spent years trying to refute the theory. Today indeterminacy seems to be largely accepted as an ontological feature of reality. There is no hope anywhere that there would be a solution to the problem of indeterminacy[8] (Tracy p. 291 against Drees p. 232 in Russell, Murphy and Peacocke 1995).

---

[8] Polkinghorne *The Quantum World* contains a long narrative on the skepticism of Einstein regarding Quantum Theory.

VI. Conclusion

I have the feeling that I have barely scratched the surface of what needs to be said about Quantum Causation. There are characteristics that I do not have had the time for to completely think through (for example the issue of observation and what happens between observations, implications for theology) and the space of this paper would not have been enough if I had done so.

I think Quantum Causation is an important link to science that has been neglected by theologians due to the fear of proposing another God of the gaps. What is not seen is that these gaps are widely accepted as ontological even by scientists. Investigation of issues in Quantum Causation needs to be pushed forward and might result in a new way of integrating science and theology. It has the potentiality of overcoming the old enmity between both fields and lead to fruitful cooperation between those fields.

Quantum Causation is also very useful as a tool for the building of a bridge from the popular faith in science to faith in God. It would allow us to overcome the two language or complementary language symptom that has been hampering theology for so long. It would overcome the otherworldliness by allowing the expressing of faith in terms of current ways of thinking available in science.

VII. Books consulted

Audi, Robert ed. *The Cambridge Dictionary of Philosophy*. Cambridge University Press, 1995.

Barbour, Ian. *God and Evolution* Syllabus for Course PH870. Winter 1997, Fuller Theological Seminary.

Blackburn, Simon. *The Oxford Dictionary of Philosophy*. New York: Oxford University Press, 1994.

Davies, Paul. *Other Worlds*. New York: Simon and Schuster, 1980.

Dyrness, William. *Christian Apologetics in a World Community*. Intervarsity Press, 1983.

Hawking, Stephen. *Black Holes and Baby Universes and other Essays*. Bantam Books, 1993.

Jewett, Paul K. *God, Creation and Revelation*. Grand Rapids: Eerdmanns, 1991.

John Gribbin. *In Search of the Big Bang: Quantum Physics and Cosmology*. New York: Bantam Books, 1986.

Murphy, Nancey and George F.R.Ellis. *On the Moral Nature of the Universe.* Minneapolis: Fortress Press, 1996.

Peacocke, Arthur. *Theology for a Scientific Age*. Minneapolis: Fortress Press, 1993.

Peebles, P.J.E. *Quantum Mechanics*. Princeton: Princeton University Press, 1992.

Polkinghorne, J.C. *The Quantum World*. New Jersey: Princeton University Press, 1984.

Russel, Murphy and Peacocke ed. *Chaos and Complexity: Scientific Perspectives on Divine action*. Notre Dame: The University of Notre Dame Press, 1995.

Russell, Murphy and Isham. *Quantum Cosmology and the Laws of Nature: Scientific Perspectives on Divine action*. Notre Dame: The University of Notre Dame Press, 1993.

Templeton, John Marks and Robert L. Herrmann. *Is God the Only Reality?* New York: Continuum, 1994.