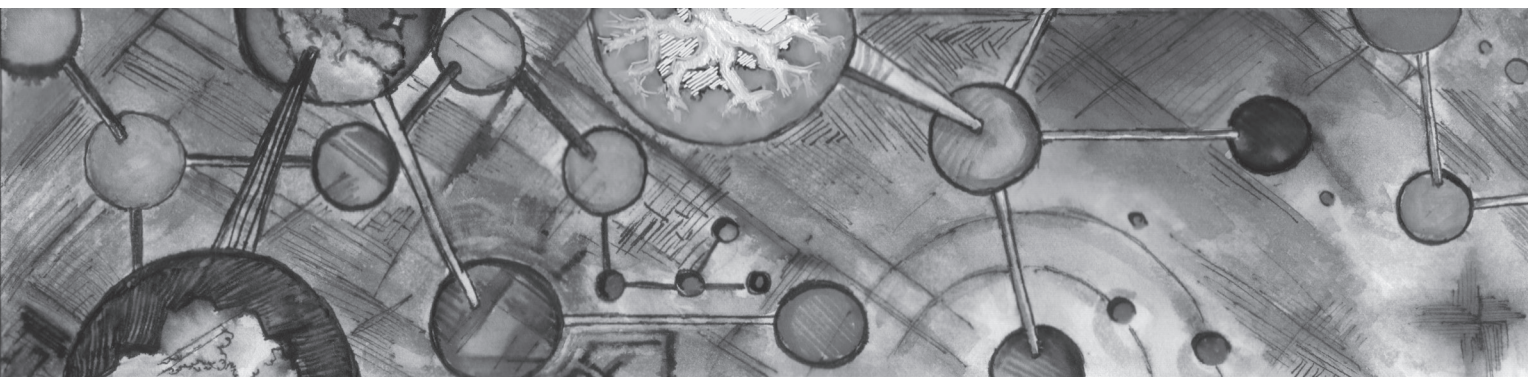


Quantum Mechanics and *Divine* Action

by Emily DeBaun



by Jen Freise '12

DOES GOD ACT IN THE PHYSICAL WORLD? IF so, how? An atheist might say that if science can explain an event, God is not a necessary explanation for that event's occurrence, and therefore God neither acts in the physical world nor exists. On the opposite end of the spectrum, a Christian might say that if God is supernatural, he can operate outside of physical means, and therefore his actions in the world will necessarily violate physical laws. The philosophical implications of quantum physics, however, give a different perspective. Quantum mechanics allows for a type of divine action that does not violate the laws of physics and yet accords with scriptural accounts of God's providence and miracles.

This article concerns itself with how God operates within the laws of nature, or, as Robert Russell refers to it, "noninterventionist divine action."¹ This piece does not seek to prove definitively that such action occurs or that it is the only way in which God operates; rather, it shows that scientifically speaking, the door is open for its possibility. Furthermore, this possibility can be supported by biblical theology. To demonstrate how quantum mechanics makes noninterventionist divine action possible, we begin with the way in which classical physics rules out its possibility.

Classical physics, generally speaking, refers to physics formulated prior to the development of theories about relativity and quantum mechanics. It includes the work of Newton, Kepler, and Galileo, among others. Classical mechanics is founded upon several fundamental principles. The *Stanford Encyclopedia of Philosophy* identifies these as "the principle of space and time, the principle of causality, the principle of determination, the principle of continuity, and the principle of conservation of energy."²

Essentially, classical events occur in space and time; the state of a classical system flows continuously from previous states through a chain of causes governed by conservation of energy. Classical physics poses a problem for noninterventionist divine action because it is by nature deterministic. If a system's state is entirely controlled by previous states and a future state can be precisely predicted based on the forces that influence the current system, then the operation of the physical world is simply a giant, deterministic causal chain.³ In such a system, God could act in a way to alter forces or change patterns of causation, but he would necessarily violate physical laws in tampering with the classical causal chain. This would constitute divine action, but not noninterventionist divine action. The



The Wedding at Cana
by Julius Schnorr von
Carolsfeld, painted
c. 1820, depicting
Jesus turning
water into wine

deterministic nature of classical physics supports the notion that God is not a necessary explanation for the occurrence of physical events. Quantum mechanics, however, paints a strikingly different picture.

Today, quantum mechanics centers on the notion of a wave function, a mathematical formulation relating the time and position of an object. This wave function must satisfy Schrodinger's Equation, a differential equation regulating the evolution of the system in time. These mathematical formulations constrain the system; different observable quantities can only take on certain discrete (or quantized) values. The general interpretation of the wave function itself is that it can be used to determine the probability of a particle existing in a certain state. Essentially, the mathematical formulation of quantum mechanics shows the possibilities and probabilities for a particular quantum state but fails to predict, in the deterministic way typical of classical physics, what a scientist will measure if he or she attempts to extract information from the system.⁴

This limitation suggests a strange relationship between a quantum system and its observer. According to the widely accepted Copenhagen interpretation of quantum mechanics, a system is in an indeterminate state comprised of a superposition of all possible states until a measurement is made upon it, at which point the wave function is "collapsed," and the system

is forced to take on the measured value.⁵ A common thought experiment to describe this is "Schrodinger's Cat." If a cat is placed in a closed box with a quantum device that has a fifty percent chance of releasing cyanide to kill the cat, the cat will be in a strange, superimposed state of both life and death until the box is opened. When the system is plainly observed, the cat is forced to be either dead or alive, as the wave function is collapsed and the system takes on one of the two possibilities.⁶ Generally, a quantum system is indeterminate until a measurement is taken, at which point the system takes on the measured value, which is one of several possibilities whose probabilities are determined using the wave function.⁷

This fundamental indeterminacy at the root of quantum events is scientifically inexplicable. Though the possibilities and probabilities of quantum events can be determined, the choice of which possibility occurs appears to be entirely random. This makes non-interventionist divine action possible. According to Nicholas Saunders, there are four potential ways in which God could intervene in this situation. The first possibility is that God "alters the wave function between measurements" by adding new possibilities to the superposition of potential outcomes. Saunders rejects this explanation on the grounds that for God to introduce new possibilities would be interventionist

because between measurements, Schrodinger's Equation deterministically dictates the progress of the possibilities of the system.⁸ Saunders next mentions the idea that God could himself "make measurements on a quantum system;" this notion is also dismissed as interventionist because it would require God to somehow set up the physical experiment and laboratory in the first place.⁹ A third possibility is that God changes the probability of different event outcomes. Saunders, again, calls this interventionist because to alter the probabilities would require changes to be made to the wave function.¹⁰

The final possibility holds the most promise: God may simply "determine the outcome of a measurement," choosing which possibility is manifested out of those given in the superposition prior to measurement.¹¹ This is a reasonable proposition, since for God to choose the outcome of a measurement would not require him to violate any law of physics, but rather to determine a path from among several natural possibilities. Philosopher Nancey Murphy supports this idea, stating that the timing of a quantum event cannot be "internally or externally determined" without "sufficient reason to act."¹² This means that a quantum event will not occur for no reason; there must be a way to distinguish between possibilities in order to give an event a "sufficient reason" to choose one possibility over another. She concludes that if quantum processes are either entirely random or divinely determined, only divine action could provide sufficient reason for the event to occur. This is because God could externally evaluate and select one of the possibilities, while a random process would have no "reason" to choose one possibility over another and therefore would be incapable of acting.¹³

Robert Russell also endorses the idea that God determines the result of measurements taken in quan-

that the quantum event is "ontologically indeterminate."¹⁵ From all of this he concludes that it is possible for God to uphold quantum processes through "direct, noninterventionist action."¹⁶

Saunders argues against the idea of God determining the outcome of a quantum measurement, but not on the grounds that it is interventionist. Rather, he claims that for God to "ignore the probabilities predicted" and to "control" what happens is to say that the probabilities we obtain from experiment determine, rather than confirm, the probabilities predicted by the wave function.¹⁷ Saunders writes, "...the probability laws simply reform around whatever actual measurement results have been obtained... this approach is characterized by an assertion that individual events are ontologically superior to laws."¹⁸ This rejection, however, is a rather unfair evaluation of the fourth quantum possibility for noninterventionist divine action. As Thomas Tracy writes in his review of Saunderson's book,

A theologian interested in noninterventionist special divine action will not say that God ignores the probability distributions predicted by quantum theory. Rather, the thesis would be that God might act in the world by determining quantum events within the ordinary probability patterns, which do, after all, permit wide variation in particular outcomes from instance to instance.¹⁹

It seems Saunders overlooks an important premise of statistics; though certain outcomes have low probabilities, they are still possible. According to statistics, the "law of averages" does not exist, meaning the aggregation of numerous event outcomes does not have to match the predicted probability density, though it will most likely come close. God would not be required to "ignore" probabilities but could choose freely within the possibilities without violating or invalidating probability distributions offered by the wave function. He

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tum systems. He defines measurements as "irreversible interactions" with a quantum system that render the Schrodinger Equation incapable of describing the system.¹⁴ Russell explains that when no measurement is being taken, the Schrodinger Equation gives the "formal cause," or arrangement, of the system, and the potential energy provides the "efficient cause," or source, of the evolution of the system. During a measurement, the equation is no longer relevant, so Russell concludes that there are indeed "material causes," or physical means by which the measurement is taken, but there are not "efficient causes" of the interaction. From this, he concludes, as does the Copenhagen interpretation,

could do this in a way that is purposeful, even if it appears random to scientists. For these reasons, Saunders' critique of noninterventionist divine action at the level of the quantum event measurement is unsuccessful.

This idea that God chooses the outcome of the measurement falls within a "bottom to top" description of how God can interact with the world without violating laws of nature. By altering fundamental quantum events, he is also able to control the macroscopic events to which they give rise without breaking the laws of physics.²⁰ Both Russell²¹ and Murphy support this concept. Murphy goes so far as to say that "top to bottom" models of divine action, where

a person experiences God's intervention in a macroscopic way or in the form of direct revelation, can also be explained by this "bottom to top" notion. For example, a sudden spiritual realization or remembrance which a person experiences could be a product of a manipulation on the quantum mechanical level that impacts neurons that affect brain function and therefore meaning perceived by the mind. She uses this as an explanatory tool for religious experience and thus extends quantum-level divine action to human experience and everyday events.²²

Some may argue that this quantum possibility for divine action is a "God in the gaps" argument, that is to say, an argument where divine action is used to explain unknown gaps in a physical process that one day will be filled in by a scientific explanation. Russell distinguishes strongly between his argument for divine action in quantum mechanics and "God in the gaps."²³ He writes,

An epistemic gaps argument is based on what you don't know. It invokes God to explain things that we don't yet understand but that science will eventually explain. Our approach is based upon what we do know about nature, assuming that quantum physics is the correct theory and that it can be interpreted philosophically as telling us that nature is ontologically indeterministic.²⁴

Russell refutes this accusation by emphasizing that his approach is an interpretation of known information, rather than a postulation about a gap in knowledge. Since the Copenhagen interpretation is widely accepted, and it states that quantum systems are "ontologically indeterministic," Russell can argue that the question of how the wave function collapse "chooses" a particular measured value is not one that can or will be solved scientifically, and it can therefore be approached philosophically.²⁵ Additionally, all these claims about divine action in quantum mechanics are not attempting to be "proofs" for God, but rather, to show the plausibility of a higher power's influence over such circumstances.

Having established that quantum mechanics provides an opportunity for God to noninterventionally act in the world, we proceed to a few scriptural examples to support how the Christian can accept non-interventionist divine action as one aspect of the way God works. The first such example is described by Wayne Grudem in his *Systematic Theology* as the "concurrency" component of God's providence. Grudem defines concurrency as God's "cooperation with" and "direction of" creation.²⁶ Scripture teaches that such

divine direction can happen through natural causes. He cites Psalm 104:14, "You cause the grass to grow for the livestock and plants for man to cultivate."²⁷ Here it is clearly seen that God often provides for man through natural processes, such as feeding him by causing food to grow. In the "preservation" component of God's providence, Grudem cites Hebrews 1:3, "he upholds the universe by the word of his power,"²⁸ and Nehemiah 9:6, "You have made... earth and all that is on it, the seas and all that is in them; and you preserve all of them."²⁹ Again, God is seen as preserving and providing for his creation in an intimately physical way. One means by which God manifests his power is through natural processes.

The idea of miracles as "an exception to a natural law" may cause Christians to question the idea of non-interventionist divine action.³⁰

Nancey Murphy addresses this issue, writing, "I prefer not to use the term 'miracle' because it is now so closely associated with the idea of a violation of the laws of nature. I believe it could be shown that the primary reason for current rejection of miracles, in fact, has been this very definition."³¹ Murphy contends for a notion of the "miraculous" that includes incredible occurrences that do not violate nature. Noninterventionist divine action in quantum mechanics producing awe-inspiring macroscopic results could, indeed, be explained by natural causes.³² However, the occurrence of such an unlikely event, influenced by divine action, places it in the "miracle" category.

Grudem also endorses the classification of such an occurrence as a miracle. He defines a miracle as "a less common kind of God's activity in which he arouses people's awe and wonder and bears witness to himself."³³ Grudem defends this definition by pointing to three biblical words associated with God's "less common activity"—"signs," "wonders," and "miracles" or "mighty works." Grudem says "signs," biblically, are things that draw attention to "God's activity or power."³⁴ In referring to Jesus' transformation of water into wine, John 2:11 supports this definition: "This, the first of his signs, Jesus did at Cana in Galilee, and manifested his glory."³⁵ Here, a sign is directly linked to the "manifestation" of Christ's "glory"; God's "activity" and "power" are manifested in Christ's action. Grudem says "wonders" are awe-inspiring acts;³⁶ this is supported by Exodus 15:11, which says, "Who is like you, O LORD, among the gods? Who is like you, majestic in holiness, awesome in glorious deeds, doing wonders?"³⁷ Here, God's ability to perform "wonders" elicits the speaker's awe and praise as he remarks on God's uniqueness in power and "deed." Finally, "miracles," or "mighty

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works” are occurrences displaying “divine power.”³⁸ This use of “miracles” is seen in 1 Chronicles 16:11-12, “Seek the LORD and his strength; seek his presence continually! Remember the wondrous works that he has done, his miracles and the judgments he uttered.”³⁹ Here, God’s “wondrous works” and “miracles” are, indeed, associated with his power (“strength”) and his intercession (“presence”). These biblically informed definitions of “signs,” “wonders,” and “miracles” certainly do not exclude events with natural explanations. Rather, any unusually amazing action performed by God that elicits praise or awe or thanksgiving toward God may be considered a miracle.⁴⁰ Grudem says the idea of miracles as only events that violate physical laws is insufficient because it does not require God as the causer of the event, limits the extent to which God can intervene in the physical world, and reduces attention to many “actual miracles” leading to an “increase in skepticism.”⁴¹ In general, miracles, biblically defined, do not require a violation of physical laws, so Christians can view noninterventionist divine action as one potential cause of miracles.

The ontological indeterminism that the Copenhagen interpretation ascribes to measurements taken on quantum mechanical systems allows for divine action that does not violate the laws of nature. It provides the opportunity for God to intervene in the physical world and combats the idea that a scientifically explained process can have no supernatural influence. At the same time, this noninterventionist divine action accords with biblical notions of God’s providence and miracles. In essence, the indeterminism at the root of quantum mechanics, the most fundamental description of the physical world, reveals to both non-Christians and believers how God could intimately influence, without being bound or proved false by, the laws of nature.

¹ Robert Russell, “Divine Action and Quantum Mechanics,” *Philosophy, Science, and Divine Action*, ed. F. LeRon Shults, Nancey Murphy, and Robert J. Russell (Boston: Koninklijke Brill NV, 2009) 354.

² “Copenhagen Interpretation of Quantum Mechanics,” *Stanford Encyclopedia of Philosophy*, <<http://plato.stanford.edu/entries/qm-copenhagen/>>.

³ Ibid.

⁴ David J. Griffiths, *Introduction to Quantum Mechanics* (Prentice Hall, 2004) 1-5.

⁵ Ibid. 3-5.

⁶ Paul Davies, *God and the New Physics* (New York: Simon and Schuster, 1983) 114.

⁷ Nicholas Saunders, *Divine Action and Modern Science* (Cambridge: Cambridge University Press, 2002) 142.

⁸ Ibid. 149-50.

⁹ Ibid. 151-52.

¹⁰ Ibid. 152-53.

¹¹ Ibid. 156.

¹² Nancey Murphy, “Divine Action in the Natural Order,” *Philosophy, Science, and Divine Action*, ed. F. LeRon Shults, Nancey Murphy, and Robert J. Russell (Boston: Koninklijke Brill NV, 2009) 283.

Russell 369.

¹³ Ibid.

¹⁴ Russell 369.

¹⁵ Ibid. 371-72.

¹⁶ Ibid. 374-75.

¹⁷ Saunders 154-55.

¹⁸ Ibid.

¹⁹ Thomas Tracy, “Divine Action and Modern Science (review),” *Notre Dame Philosophical Reviews*, <<http://ndpr.nd.edu/review.cfm?id=1319>>.

²⁰ Murphy 285-86.

²¹ Russell 360-62.

²² Murphy 293- 94.

²³ Russell 354.

²⁴ Ibid.

²⁵ Ibid.

²⁶ Wayne Grudem, *Systematic Theology* (Leicester: Inter-Varsity Press, 2001) 317.

²⁷ Psalm 104:14.

²⁸ Hebrews 1:3.

²⁹ Nehemiah 9:6.

³⁰ Grudem 356.

³¹ Murphy 271.

³² Ibid.

³³ Grudem 355.

³⁴ Ibid. 356.

³⁵ John 2:11.

³⁶ Grudem 356.

³⁷ Exodus 15:11.

³⁸ Grudem 356.

³⁹ 1 Chronicles 16:11-12.

⁴⁰ Grudem 358.

⁴¹ Ibid. 356.



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