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## Holistic Determinism and God's Action in Nature's World: David Bohm and Quantum Theology

Carl Peterson and Ted Peters 

### ABSTRACT

Can a theology of divine action within nature's world be rendered coherent and consonant with (1) classical determinism, as plied by Newtonian mechanics? No! With (2) quantum indeterminism as plied by Niels Bohr and Werner Heisenberg? Yes! With (3) holistic determinism as plied by David Bohm? Maybe, if we take the perspective of proleptic holism. The proleptic theist will test the viability of downward causation from whole to part and future to past, knowing that the whole of the history of God's creation is only proleptically complete.

### KEYWORDS

Classical determinism; quantum indeterminism; holistic determinism; Isaac Newton; Albert Einstein; Niels Bohr; Werner Heisenberg; David Bohm; Robert John Russell

*Quantum Theology* is a portmanteau of quantum physics and systematic theology. How should the theologian begin to reflect on God's relation to the world considering quantum physics?

Among the many alternative interpretations of the data, two stand out as the most viable scientific candidates. The first is the Copenhagen-Bohr indeterministic interpretation. The second is the Einstein-Bohm deterministic interpretation. Should the theologian wait to see which theory prevails before jumping in with a theory of divine action? Or might the theologian draw out implications of each, treating each as an alternative hypothesis?

Of the quantum theological theories bouncing around these days, we – physicist Carl Peterson and theologian Ted Peters – give our attention to the subtle yet profound rendering offered by the founder of the Center for Theology and the Natural Sciences, Robert John Russell. Russell relies solely on Niels Bohr's indeterministic interpretation. Why? Because with indeterminism the theologian finds an opening – not a gap – for divine action that is both real yet in consonance with the worldview of the scientist. A summary of Russell's position appears in the handy acronym, NIODA, standing for *Non-interventionist Objective Divine Action*.<sup>1</sup>

Relying on the indeterminist interpretation of quantum phenomena proffered by the Copenhagen school, especially the indeterminist ontology Werner Heisenberg adds to Niels Bohr's formalism, Russell has been able to describe divine action at the subatomic level which breaks no laws of nature as God providentially guides the course of physical events.<sup>2</sup>

That is NIODA developed by Russell. It will be our thesis in this article that the systematic theologian should not avoid the alternative, namely, the deterministic and holistic interpretation of quantum mechanics proposed by physicist David Bohm. In what follows we will demonstrate the value of Bohmian theory for theological reflection. We will further demonstrate that a variant of NIODA could be justified within the framework of David Bohm's ontology.

Let us clarify two presuppositions at the outset. First, what Russell wants and what we want is a non-interventionist account of divine action in nature's world. The problem with the closed causal nexus of Newtonian physics is that divine action could occur only as an intervention in natural processes, as a miracle. What Russell rightly pursues is non-miraculous divine action in providence. Russell does not deny that miracles occur, to be sure. It is simply the case that he along with quantum theologians in general seek an account of non-miraculous divine action.

Secondly, the determinism Russell rejects does not comport with the determinism of David Bohm. For good reason, Russell rejects Newtonian clockwork determinism which, in effect, is pre-determinism. The Bohm model, in contrast, includes dynamism, change, evolution, and even history. How is this the case? We will demonstrate how the dynamism of history that corresponds with the biblical understanding of divine action is consonant within David Bohm's ontology. Even though consonant regarding Bohm's holomovement, the theologian must take a step beyond the science to embrace a theological claim, namely, God has promised an eschatological future that is redemptive.

In brief, today's amicable jousting over worldview construction sports three lances coming from different directions: (1) *classical determinism* plied by Newtonian mechanics; (2) *quantum indeterminism* plied by Niels Bohr and Werner Heisenberg in the Copenhagen School; and (3) *holistic determinism* plied by Albert Einstein's legacy, especially through David Bohm.

Here is our question: can a theological description of divine action in the physical world be rendered consonant with the third of these, the holistic determinist interpretation of quantum mechanics?<sup>3</sup>

## The Mechanistic Determinism of Classical Physics

The clockwork universe we inherited from René Descartes and Isaac Newton—what we call *classical mechanics*—has bedeviled theologians for four centuries. Why? Because there's no room in such a world machine for God's providential action. Nor is there room for human subjectivity. Nor is there room for freely willed actions that change the physical world. Who can liberate us from our incarceration in a deterministic world that neither God nor human can influence?

Newton's genius was to produce clear and uncomplicated experiments assuming a *deterministic, local, and mechanistic* order. Newton treated physical phenomena with continuum mathematical analysis, using the Cartesian coordinate grid system, which unified the understanding of the entire physical universe, both earth and the heavens.<sup>4</sup> One world! One set of laws that always obtain and never go on a holiday.

According to what would become Newton's classical mechanics, all causes and all effects are assigned to bodies and forces inherent in physical nature. Our world runs like a colossal machine, like a jumbo Swiss watch. Like keeping an eye on the gears turning in the astronomical clock in Strasbourg's Cathédrale Notre-Dame, the scientist armed with Newton's laws of motion and gravitation could predict the actions of terrestrial objects and the solar system as well. Both heaven and earth obey a single set of mechanical laws.

"I have no need for a God-hypothesis to explain the orbits of the planets," Pierre-Simon Laplace is said to have told Napoleon. Nature is exhaustively deterministic and self-explanatory, according to classical mechanics.<sup>5</sup>

What's a providential God to do in a world like this? Is God locked out of the world he created? Is God out of a job? Is God's only job to create the universe *ex nihilo*, impart Newton's laws of motion and universal gravitation, and then retire on permanent vacation in Acapulco? How could a theologian account for ongoing divine action in a universe that is already a closed mechanical system?

Might the theologian appeal to miracles? Within the world of classical mechanics, we surmise that God could intervene in the natural processes by breaking a law of nature. But why should this be necessary? It's God's world, after all. Why should God have to intervene? The theologian wants to account for God's non-miraculous activity as creator, preserver, and redeemer. But how could a theological account of divine action be consonant with the scientific worldview?<sup>6</sup>

Might quantum theory come to the rescue?<sup>7</sup> Might new discoveries in quantum mechanics over the last century liberate both God and human consciousness from incarceration in the world machine? Even though the laws of classical mechanics still obtain at the everyday or meso-level, the world looks different at the microlevel.<sup>8</sup> At the microlevel electrons dance in and out of measurable reality. Might theologians locate divine action at the quantum level of reality?<sup>9</sup>

### Scientific Perspectives on Divine Action

From 1987 until 2002, the Vatican Observatory in Rome partnered with the Center for Theology and the Natural Sciences in Berkeley to investigate divine action in nature's world. The indeterministic interpretation of quantum physics proffered by the Copenhagen school especially attracted theological interest, because it seemed to open nature to divine action without intervention into an otherwise closed system. "Now in order for such divine action to be truly non-interventionist," said Robert John Russell, "nature at least at some level must be thought of as causally indeterministic."<sup>10</sup> Here is Russell's key: if nature is ontologically indeterministic, then God can act within nature without breaking any laws of nature. God can act within nature without intervening. In sum, indeterminism at the quantum level seemed to open the world machine to divine action without abrogating any laws of nature.

But, as we said in the introduction, we press another question: must we rely solely on this indeterminist interpretation of quantum mechanics?<sup>11</sup> Might the holistic yet still determinist interpretation of quantum mechanics also be rendered consonant with divine action? Might the theologian account for non-interventionist divine action with a non-mechanistic determinism? If so, how?

So, our agenda here is to address this agenda: might the post-quantum holistic determinism of physicist David Bohm be rendered consonant with divine action as the theologian understands it? We will test the eschatological vision of the proleptic theist on these questions. But first the story of the rise of holistic determinism.

### Einstein and the Hatching of Quantum Mechanics

It was Albert Einstein (1879-1955) who released us from the deterministic grip of classical mechanics. He did not intend to. But his indulgences into quantum physics uncovered hitherto unobservable though fundamental behaviors that resisted becoming just

more gears in the world machine. Is there room down there in the sub-atomic realm for divine action?

It was Einstein who gave us special and general relativity. It was Einstein who explained Brownian motion. It was Einstein who gave us the equivalence of energy and mass immortalized through the equation  $E = mc^2$ . It was Einstein who explained the photoelectric effect (quantum of light), a pivotal step in the development of quantum theory. Even though Newton's laws continued to obtain for your and my observable world, the hidden world welled up with incongruities and conundrums and even mysteries.

Despite the excitement of puzzles at the quantum level, thought Einstein, finally the determinism of Newton's world machine should still obtain.<sup>12</sup> We simply need to study the physical world more. More experiments. More knowledge. There's an epistemic gap that future science will eventually leap. Then, we can once again realize that the world we live in is orderly, regularized, and exhaustively determined.

Thus, Einstein was led to a world view comprised of three beliefs for a fundamental theory describing that reality: *locality*, *realism*, and *determinism*. Generally, one sees in publications and books the combination of the first two as local realism. *Realism* is taken to mean particles exist in the world independently of one other, and independently of an observer being conscious of them. *Locality* is taken to mean particles may have correlations with one another through signals not to exceed the speed of light. *Determinism* is a combination of cause and effect, that is, future events are the result of past causes.

Recall that Einstein wrote four threshold-crossing papers in 1905. Another paper explicating the general theory of relativity was published later in 1915. For our discussion here, it was Einstein's photoelectric effect paper that is most important. Here Einstein hypothesized that light consists of particles. And, because particles are localized objects, they can transfer their energy during a collision. In this way photoelectric phenomena can be understood.

Can one quantify light particles? Does the idea of a light quantum make sense? With the subsequent theoretical activity and ensuing debates, quantum theory within physics began to hatch like a newborn chick.

The second pip connected Einstein's light quantum with what would become Niels Bohr's model of the atom.

## Bohr and the Hatching of Atomic Theory

Niels Bohr came on the scene in 1911 armed with a Ph.D. from the University of Copenhagen and schooled in the Newtonian paradigm. He spent several months of that year studying with J. J. Thomson, who had discovered the electron in 1897.<sup>13</sup> Then in 1912, Bohr began working with Ernest Rutherford, who had won the Nobel Prize for chemistry for his investigations into radioactive substances in 1908. Rutherford at this time was working with the atom and its various mysteries. He had in 1911 hypothesized that the nucleus of the atom was extremely dense, and widely separated from the electrons.

Using Rutherford's model of the atom, Bohr was able to explain the *line spectrum* and *stability* of the hydrogen atom.<sup>14</sup> Bohr's insight in developing this model was founded on the assumption that Planck's quantization hypothesis for radiation oscillators was correct. That is, the energy of an oscillator with frequency,  $\nu$ , is bound to integral

multiples of a given unit  $h\nu$  with its *energy* given by  $E = nh\nu$ , where  $n$  may be an integer from 1 to  $\infty$ , and  $h$  is Planck's constant. This equation suggests that there is a classic limit that follows naturally from Planck's hypothesis. That is, when  $n$  is very large the quantization aspects are negligible.

Bohr hypothesized that he might find the key to unlock these dual mysteries by working with and understanding Planck's hypothesis. Through this work and the success with experiments verifying his hypothesis, his fame increased and circulated internationally.

Already at the first pip in the hatching of quantum theory, the albumen differentiated. Both Einstein and Bohr examined the same yolk: the same quantum phenomena. Yet they interpreted what they saw differently. Bohr's interpretation was indeterministic. Einstein's was deterministic.

### Bohr's Indeterminism and Einstein's Determinism Meet

Einstein and Bohr first met when Bohr gave a lecture in April 1920 in Berlin, "and the two immediately proclaimed unbounded admiration for each other as physicists and as human beings."<sup>15</sup> However, even with this first meeting there was an indication of disagreements that might blossom into a life-long debate. At that time, it was the light-quantum. Bohr had trouble believing light traveled like a particle.<sup>16</sup>

Theoretical physics activity was on-going when Einstein met Bohr, and this included much of what is called early quantum theory. Early quantum theory included Einstein's light-quantum proposal along with Bohr's model of the atom. Also, theoretical physicists were busy working on other changes and conceptual challenges to various classical theory beliefs in the 1920s such as: (1), the concept of a continuous and precisely defined trajectory was fundamentally altered by the introduction of a description of motion in terms of a series indivisible transitions; (2), and the rigid notion of determinism was softened by the concept of causality as an approximate and statistical theoretical approach; (3), also the rigid assumption that *elementary* particles are "intrinsic" in their essence and can never change was replaced by the assumption that they can act either like waves or like particles, depending on how they are analyzed and interpreted in their surrounding environment.<sup>17</sup>

So that, by the time of the Fifth Solvay Conference in October 1927,<sup>18</sup> a quantum algorithmic procedure and correct experimentally predictive quantum mechanical theory had been developed. That is, the theory had become quite successful in predicting the results of experiments.

Quantum theory then contained all of the *component parts* such as Erwin Schrödinger's equation, Born's statistical interpretation, Heisenberg's uncertainty principle, and the required postulates, and theorems as well as definitions. But unquestionably, the most important justification for quantum theory, as developed, was its success, as stated in a previous sentence, in predicting the experimental results of the various microscopic systems.

However, for Einstein, the theory just didn't feel right. Even so, Einstein did speak at the conference. He apologized "for not having penetrated quantum mechanics deeply enough."<sup>19</sup> Nevertheless he wanted to provide some remarks. After saying that, he continued by taking several minutes to point out, (1), a problem with *the measurement*

event,<sup>20</sup> as well as an *apparent contradiction* between special relativity and the more recently developed quantum mechanics concerning *simultaneity*. Then he sat down.

When Bohr took the floor, he indicated that he didn't understand Einstein's point. But it was probably his fault that he didn't understand. Then Bohr proceeded to give his rebuttal based on the principle of complementarity. Thus began the "talking past each other" phase of the debates.<sup>21</sup> The two giants of twentieth century physics engaged one another while maintaining the highest regard for one another.

Einstein's continuing valuable contributions to quantum mechanics, after he spoke at the 1927 Solvay Conference, took the form of challenges and criticisms through thought experiments with Niels Bohr on the formal structure comprising the Copenhagen Interpretation and formulation. In this regard, Einstein had posed a challenge to the uncertainty principle at the 1927 conference outside of the public sessions. It was addressed by both Einstein and Bohr at the 1930 Solvay Conference.<sup>22</sup>

Einstein did not add another challenge to quantum mechanics until he and two of his assistants published a paper five years later, on May 15, 1935, in Volume 47, of the *Physical Review Journal* entitled: "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?" It is known to the world as the EPR Paradox.<sup>23</sup>

And what an impact! In the next section we comment on EPR's impact to a limited extent considering the title to our paper. What a philosophical debate!

## EPR and the Elements of Physical Reality

First let's take up EPR's challenge to quantum mechanics for not being complete. The EPR authors' objection to completeness was based on physical elements in the world defined as real. Real yet without being observed and known and understood by humans through the five senses, experience, and intellect.

Therefore, EPR proposed a sufficient condition for those types of elements of reality through an if-then statement. If, without disturbing the system in any way, and at the same time, the value of a given physical quantity can be predicted with certainty; that is, with probability equal to unity, then that physical quantity corresponds to an element of reality. Although this is not a necessary condition it is sufficient by any standard in physical science.

In physics this takes the form of experiment and measurement of elements of physical reality. To judge the theory EPR asked two questions: (1) is the theory correct, and (2) is the description given by the theory complete? EPR's approach was to base their criticism about quantum mechanics on the second question. And then demonstrate that there is a *contradiction* with the uncertainty principle. According to the uncertainty principle: for two particles A and B moving right and left respectively, which is embedded in the theory's formalism, only probabilities are given for measurements of a coordinate lying between the distance  $a$  and  $b$ .

That means: "A definite value of the coordinate, for a particle in the state given by" the Schrödinger wavefunction,  $\Psi$ , "is thus not predictable, but may be obtained only by a direct measurement. Such a measurement however disturbs the particle and thus alters its state. After the coordinate is determined, the particle will no longer be in the state given by,"  $\Psi$ . "The usual conclusion from this in quantum mechanics is that when the momentum of a particle is known, its coordinate has no physical reality."<sup>24</sup>

EPR, in their paper, presented a demonstration that a precise position and momentum, through an experimental situation involving two particles *A* and *B*, can exist at the same time and are therefore *elements of reality*. Then it follows that quantum mechanics as presented cannot provide a description of that quantum state, and is therefore incomplete.

Yes, Bohr did respond.<sup>25</sup> And, “appreciating the penetrating criticism of EPR,” Bohr took great care in formulating his response. Essentially this consisted in pointing out that his own approach of complementarity still applied, since the particles *A* and *B* should not be considered two quantum systems. The particles came together and made up one quantum system by interacting and are correlated. And, the particles remain correlated no matter how far apart they move. Therefore Bohr, in his response, stressed a different concept of reality than EPR had laid out.

When it comes to the relationship of a concept to reality, Bohr and Einstein differed somewhat. For Bohr a concept represents *reality* in so far as it is in *unambiguous correspondence* with the whole set of possible phenomena, and these phenomena are necessarily such that they have to be described in terms of the concepts of *classical physics*, that is, the Newtonian paradigm. For Einstein, however, concepts are a “free creation of the human mind” and their *correspondence with reality* is at first assumed and then tested by the phenomena they predict.<sup>26</sup>

As a result, the simultaneous reality of all of particle *B*’s properties is not a concern even without observation. Bohr believed it is totally inadmissible to use concepts in this way in quantum theory. Properties are complementary. Therefore, when the quantum system is measured for position, its reality is different from a measurement on the system for momentum.

Einstein declined to accept Bohr’s rebuttal. It was unclear who might be closer to the true concept of microphysical reality, since Bohr sincerely believed he was correct with his complementarity position. As a result, they assumed their difference was philosophical.

Many physicists agreed with Bohr’s position because of the non-intuitiveness, strangeness, and the *ontological ambiguity* of quantum theory. On the other side, Einstein’s “free creation of the human mind”, is a concept that can lead one to making choices that bring about change, new discoveries, to using one’s knowledge to make critical decisions. This is what Einstein himself did in the development of relativity theory. He enjoyed the eureka moments.

Do we think of free will within Einstein’s concept? And why are we rehearsing this history lesson involving Einstein and Bohr? Read on!

## **David Bohm’s “Hidden Variables” Interpretation and the Contribution of John Bell**

The EPR thought experiment interpolated two new concepts into the story of physics which, after a decade and a half, wrote David Bohm and John Bell into the narrative. Most likely Einstein himself would have given little attention or thought to these two concepts considering his beliefs about a fundamental theory describing reality, especially with the EPR paper’s emphasis on completeness.

But first, before we introduce these two concepts, we will present another few paragraphs regarding history. After EPR’s paper was published and Bohr’s rebuttal given, neither of the two eminent physicists budged from his position. So, there was no new

widespread drama through publications of either's position for about 16 years or so. But talk about completeness and the concepts necessary for representing quantum reality continued in private and at gatherings in quantum physics conferences.

During this lull period, David Bohm entered Princeton University as an assistant professor of physics in 1947. Subsequently, his initial offering on the debate for the interpretation of quantum theory was given in his well-received book published in 1951.<sup>27</sup> In this thought-provoking book, he included a lengthy discussion of the EPR experiment consisting of 13 pages.

Bohm included in these 13 pages, among others, two implicit assumptions made by EPR in their treatment: a section on the origin of correlations, and a section entitled *proof that quantum theory is inconsistent with hidden variables*.<sup>28</sup> From that proof and some earlier statements in the book, Bohm seems to have agreed with the Copenhagen view. However, a few months later, after having changed his mind about the Copenhagen view, due to conversations with Einstein, Bohm submitted two additional innovative papers to *Physical Review*.<sup>29</sup> There he laid the foundation for a suggested *hidden variables* interpretation of quantum theory. Impossible? Yes!<sup>30</sup>

But not impossible according to Bohmian mathematics! Might von Neumann's proof be limited by an error? Yes! This would no longer be a question with Bell's 1966 publication indicated in footnote 33 and discussed a little later in this paper.

Bohm's interpretation is formulated using the WKB approximation for the classical limit to quantum theory.<sup>31</sup> In this approximation the wavefunction is written in the polar form,  $\Psi = R \exp(iS/\hbar)$ , where  $R$  is the amplitude and  $S$  is the phase.<sup>32</sup> This form of the wavefunction is inserted into Schrödinger's equation, which treats the case of a particle in a potential  $V$  for definiteness. Two equations are obtained by separating the real and the imaginary parts, which rigorously correspond to the Schrödinger equation. One plays the role of the classical conservation of probability.<sup>33</sup> However, our focus is on the other equation, so we may disregard the conservation of probability equation for our work.

The other equation is the one that provides the above mentioned classical limit to the quantum theory. That is, the equation with the phase transition,  $\partial S/\partial t$ , the classical potential,  $V$ , and the quantum of action,  $\hbar$ , and was investigated for further possible developments by Bohm.

Also, it is the "conservation equation for the probability in an ensemble of ..particles, all moving normal to the same wavefront with a probability density  $P = R^2$ ."<sup>34</sup> The equation has, in addition, the term,  $(-\hbar^2 \nabla^2 R/2mR)$ , which contains the stated  $\hbar$ . If one sets  $\hbar = 0$ , the classical Hamilton-Jacobi equation materializes. However, Bohm did not set  $\hbar = 0$ , since  $\hbar$  has a value and is never zero, so the term remains in the equation. Most importantly, the laws of motion of the particle being treated then are determined by, the classical potential,  $V$ , and that additional term with the non-zero value of  $\hbar$ ,  $(-\hbar^2 \nabla^2 R/2mR)$ , which Bohm christened the quantum potential:  $U$ . Some works call the potential,  $Q$ . The quantum potential represents additional microstructure for quantum reality. And there is more read on!

## Entanglement and Nonlocality

The first of the two key EPR concepts is *entanglement*. It entered the physics jargon because Schrödinger came out in 1935 responding to and supporting Einstein's position

concerning the wavefunction in the EPR paper.<sup>35</sup> EPR's paper has two parts, and in the first paragraph of part 2, the authors set the process for two atoms permitted to interact and separate again by departing to the right and left respectively.

In the next and subsequent paragraphs, EPR provided the quantum theoretical essentials of the process. Schrödinger in his supportive publication wrote, "I would not call that one, but rather the characteristic trait of quantum mechanics, the one that reinforces its entire departure from classical lines of thought. By the interaction, the two representatives have become *entangled*." Therein the concept of entanglement,<sup>36</sup> came into the physics jargon.

And the second key concept is *nonlocality*. Enter 23-year-old John S. Bell into this spacetime continuum in 1949, when he joined the UK Atomic Energy Research Establishment, at Harwell, Oxfordshire with bachelor's degrees in both experimental and mathematical physics. Once there, he joined the group charged with formulating a method for increasing the speeds of particles to higher and higher velocities to smash them. But most significantly for our purposes, in 1952, while he was still performing his valuable practical work, he read Bohm's theoretical article on hidden variables, since he enjoyed the challenge of, and the grappling with, investigations into the foundations of quantum theory.<sup>37</sup>

However, it would be four more years, in 1956, before Bell received his Ph.D. degree specializing in nuclear physics and quantum field theory. And it would be eight years after that accomplishment, before he published theoretical work on quantum theory, with his discussion on the EPR Paradox because of his practical work. Bell's work brought attention to the *grossly non-local* structure, the phrase which Bell used, for Bohm's "hidden variables" interpretation of quantum theory. Instead of *grossly* Bohm used *peculiar*.

This *curious feature of a grossly nonlocal character* was mentioned in Bell's 1964 and 1966 publications 29 and 31 years<sup>38,39</sup> after the publication of the EPR paper. Many times, discovering quantum reality takes a while due to its non-intuitiveness and the limits of our human senses, but we still move forward through diligent work by dedicated scholars.

The 1966 article, which was the first submitted of Bell's two papers originally inspired by Bohm's work regarding hidden variables,<sup>40</sup> had taken up space in the files of papers at the *Reviews of Modern Physics* office for two years after that edited paper was presented there for publication in August 1964. The manuscript had been misplaced. Forgotten. This mishap was due to Bell's traveling and believing the routine publication processes were taking place. When Bell had settled, he wrote to the journal and asked about his paper, which was found and immediately published.

As noted in one of the above paragraphs, Bohm had done extensive work on the EPR argument, and after conversations with Einstein, he rejected the Copenhagen view. He turned instead to hidden variables<sup>41</sup> where he was successful in finding more microstructure using the Schrödinger equation.

There was little response from the physics community. Few would accept Bohm's hidden variables interpretation. Nevertheless, Bohm continued to work and develop his theory to determine what new concepts and properties there might be due to the new microstructure: that is, the quantum potential, *U*. For a *Theology and Science* article such as this, we believe it is sufficient to discuss only some of the new features brought out by the quantum potential rather than go into the necessary mathematical physics underlying their properties.

Accordingly, quantum potential is the mechanism by which influences on far away components of a correlated system are communicated. It essentially brings together every region of space into an *unbroken whole* for the entire universe. For example, photons are used a lot to explain concepts in quantum theory.

As an illustration of this use: consider, when measuring a property on one of a pair of correlated photons, it effectively changes the quantum potential nonlocally, requiring the second photon to take on the involved properties of the first photon no matter how far apart. It should be noted that this type of non-local activity cannot be used to send coded messages or details, avoiding conflict with the postulates of special relativity. To repeat: nonlocality between far away parts of a quantum system is governed by quantum potential within the unbroken whole of the universe.

### Active Information

Besides entanglement and nonlocality, another important feature to be highlighted is *active information*. Active information has been introduced differently in the context of physics by Bohm, and we believe deserves a full paper of its own. Active information as indicated here is different from Shannon's concept used for quantifying and understanding information through bits using mathematics and data science.<sup>42</sup> In this article we will provide a very brief overview of Bohm's idea since it helps with an intuitive understanding of quantum theory.

Bohm observed that the quantum potential remains unchanged when the quantum field is multiplied by an arbitrary constant. It relies only on the *mathematical form* of the wavefunction rather than its amplitude, which suggests the consequences occurring from the quantum potential are separate from the quantum field's strength or intensity.<sup>43</sup> The impact of this observation means the results obtained from the quantum potential can be substantial even when the amplitude of the wavefunction is small.

What makes this non-mechanistic yet deterministic? In Bohmian determinism, Bohm's ontological interpretation implies that the particle (say an electron) is acted upon by both a classical potential and an additional quantum potential. Therein lies the difference. The quantum field,  $\Psi$ , is primarily interpreted as determining the motion of the particle through its velocity and the quantum potential. In Bohm's ontological interpretation the electron is a particle with a well-defined position, which is always accompanied by its quantum field  $\Psi$ , then *the whole system* of particle plus quantum field varies continuously and is causally determined.

Bohm provides three examples that are quite familiar. First, water. A water (classical) wave causes a cork to bob, that is bounce or move up and down. However, as the cork bobs further and further away from the source of the wave the less it will bob. But with a quantum wave, the quantum particle will move with full strength or intensity without consideration of distance from the source of the wave.

A second example is that of a ship put on automatic pilot in order to be guided by radio waves. Again, the impact of the radio waves is separate from their intensity and depends only on their form.

The third example is that of a silicon chip in a computer. The informational content in the silicon chip supplies a wide range of potential activities which may be manifested by supplying form to the electrical energy coming from a power source.

We have given three examples, which Bohm theorizes rely on *active information*. We will provide a little more detail for the water wave. The water wave is an example of what Bohm's says "that even the classical potential can be looked at as representing the effects of active information."<sup>44</sup> This is possible because in the many-body system, every particle individually is *guided* by the total phase of the wavefunction, which evolves according to Schrödinger's equation, and indirectly to the many-body quantum Hamilton-Jacobi equation,<sup>45</sup> where the classical and quantum potential provide particular outcomes of the guidance condition, and active information in the wave function.

Bohm's view was largely rejected by the physics community. The reasoning behind Bohm's seminal work being essentially disregarded and ignored by a majority of scientists was and is still unacceptable for a scientific community, in our judgment. Perhaps the rejection was due to the non-intuitiveness of the questions asked at that time surrounding microscopic reality, such as completeness and the interpretation of the quantum theory. Later and present-day works are more open to investigating Bohm's ideas and giving him deserved recognition.

### **Bell's Theorem and Hidden Variables**

Nonetheless, Bell threw new life and intrigue into quantum theory with his two papers and his book, *Speakable and Unspeakable in Quantum Mechanics*, originally published 25 years later in 1987 by Cambridge University Press. Bell's second paper which was published first, outlined Bell's inequality and enunciated Bell's theorem. Bell said it effectively in his conclusion; "In a theory in which parameters are added to quantum mechanics to determine the results of individual measurements, without changing the statistical predictions, there must be a mechanism whereby the setting of one measuring device can influence the readings of another instrument, however remote. Moreover, the signal involved must propagate instantaneously, so that such a theory could not be Lorentz invariant."<sup>46</sup> Said simply, *there is no local, deterministic hidden variables theory that can satisfy the statistical predictions of quantum mechanics*. However, we point out that Bohm's hidden variables are non-local.

Bell's first paper which was published secondly in 1966 discusses the problem of hidden variables in quantum mechanics. It specifically addresses von Neumann, Jauch and Piron,<sup>47</sup> and Gleason's<sup>48</sup> impossibility proofs for hidden variables. We will not reproduce these arguments here, with the exception of providing several sentences on the analysis of von Neumann, since the others were attempting to strengthen von Neumann's argument.

Bell's first criticism of von Neumann's analysis actually applies to the fact that von Neumann was "concerned to assume as little as possible about quantum mechanics."<sup>49</sup> Bell indicated this may be valuable for some purposes, but not for (mine) since (I) am only interested in the possibility of hidden variables in ordinary quantum mechanics. The question is therefore, can quantum mechanical states be regarded as ensembles of states further specified by additional variables, "such that given values of these variables together with the state vector determine precisely the results of individual measurements." These theoretical states described by additional variables are known as dispersion free states.

The second criticism is von Neumann's essential assumption for his impossibility proof, which is; "Any real linear combination of any two Hermitian operators represents an observable, and the same linear combination of expectation values is the expectation

value of the combination.”<sup>50</sup> Although this is true for quantum mechanical states, von Neumann’s assumption was that it is true for theoretical dispersion free states as well. Bell demonstrated that this is objectively false for the theoretical dispersion free states.

Furthermore, as proof for the importance of his work, Bell was nominated and the front runner for the Nobel Prize in physics for 1990. However, he died before the presentation occurred, and since a Nobel Prize is only awarded to living human beings, he failed to receive it. Nevertheless, and in vindication, Bell’s work reached the zenith of distinction and importance as three physicists were awarded the Nobel Prize in October 2022 for work on Bell’s inequalities and the experimental validation of Bell’s theorem. Those three, Alain Aspect, John Clauser, and Anton Zeilinger’s experiments were developed much earlier beginning in 1972 but winning the Nobel prize still allows the *world* and the *physics community* a chance to celebrate and communicate two important physics accomplishments that changed how we view the world specifically in physics and what it means in general concerning physical reality.

Also, it is not our intention to beat upon Von Neumann, but only to point out an error. For it was Von Neumann, who most effectively and extensively formulated and gave the *quantum state* its precise mathematical expression,<sup>51</sup> as well as delving into the many philosophical concepts due to this approach. But what is important for this article is that the quantum potential,  $U$ , is dependent on Von Neumann’s *quantum state* of the *whole system* through interactions in a non-prescribed arrangement of particles. And by *whole system*, we mean particle(s) plus quantum field.

We will not go into the mathematics of how this is accomplished. But the relationship between the various parts of the system denotes an attribute of *wholeness* of the complete system beyond the mechanistic interactions prescribed by a spatial arrangement of the particles contained therein. For it is the defining quality of mechanism that its existence consists of parts of the system which are in prescribed interactions. However, Bohm’s primary goal was to understand the nature of reality as a coherent whole.<sup>52</sup>

## Wholeness in Holomovement

For Bohm, wholeness has a history. Fundamental reality is “*Undivided Wholeness in Flowing Movement*.”<sup>53</sup> Flow means that everything is changing. But it is not a single homogeneous or undifferentiated flow, which would be indiscernible from a static subject. It is rather a flux, a movement of forms and shapes and parts abstracted from the whole as sub-totalities of movement. Human knowledge is both an abstraction from and a participation in this total flux.

This strongly suggests that Bohm’s determinism is not necessarily fixed by initial conditions at the beginning. This is not a pre-determinist scheme. Rather, Bohm’s world is dynamic, changing, and subject to whole-part or even future-past determinations.

## Holographic Wholeness

To get to undivided wholeness in flowing movement, Bohm needed to construct a vision of the whole of physical reality. This would not be easy, because the theories of relativity and quantum theory seemed to defy unification. “It is generally agreed that neither special relativity nor general relativity have been united with quantum theory in a *fully*

*consistent way.*<sup>54</sup> Simply stated, quantum theory does not *fully* cohere conceptually with the theory of relativity using our present mathematical structure.

However, we do have a relativistic quantum field theory, and using the remarkable capacity for adaptation within<sup>55</sup> the present mathematical structure, it provides many correct predictions. But the mathematical structure that displays and describes the activity for the concepts used in physical reality are put in *order* by the Cartesian coordinate grid system as stated earlier, which was precisely Descartes' purpose when he introduced his coordinate system in 1637. However, this descriptive order is deterministically causal, locally contained and mechanistically organized.<sup>56</sup> This ignores the essence or ontology of quantum and relativity theory and leads to a contradiction between their basic concepts.

Despite this, Bohm realized that one thing the two theories have in common is *undivided wholeness in flowing movement.*<sup>57</sup> Flow for Bohm means that everything is changing. But it is not a single homogeneous or undifferentiated flow, which would be undiscernible from static being. It is rather a flux, a movement of forms and shapes and units. Physical reality is not exhaustively pre-determined by initial conditions, as flux and movement imply.

Bohm asked the question: "How then can we proceed?"<sup>58</sup> Bohm decided that we can proceed as we always have "by beginning with our common intuitive notions and general experience of order and by letting these develop so as to extend into new domains and fields of application."<sup>59</sup> Let us think about this quote or any paraphrase of it and determine what the statement means.

We believe it means we need to find an *applicable order*, which provides *undivided wholeness* in our everyday life, experience and overall worldview. And it should be able to accommodate the numerous accomplishments in physics and other fields of knowledge, plus our present system of knowledge that uses the Cartesian coordinate grid system, with the flexibility for expansion into new areas of research. And this order should be adaptable to inherent mathematical expressions. This we believe was Bohm's trend of thought and what he was seeking.

And Bohm found what he was looking for in the hologram. Let us restate his undivided wholeness quest: our universe is an undivided whole. However, our universe is mathematically put in order by the Cartesian coordinate grid system for physical processes as stated in the beginning of the article. This mathematical system has been the one unchanging component in physics through various discoveries, adaptations, modifications, and continued advancements for several centuries now.

Even though the system is mechanistic, it still allows physicists to abstract theories that are contained in and make up the undivided wholeness. This system tells us the whole is equal to the sum of its component parts. The hologram and nonlocality gave Bohm new ideas about how we can understand the unbroken wholeness of our physical reality, and with it the whole is greater than the sum of its prescribed mechanistic parts.

A hologram is an interesting sub-totality with undivided wholeness characteristics: where "each region of the hologram makes possible an image of the whole object."<sup>60</sup> This characteristic tells us that if we cut a half, a fourth, an eighth, a sixteenth or any small fragmental region of the hologram, these fragmental regions nevertheless, reconstructs the whole view of the holographic image. Furthermore, "[w]hen we put all these regions together, we still obtain an image of the whole object, but one that is more sharply defined, as well as containing more points of view."<sup>61</sup>

Holograms are recordings of reflected light on a film that writes the whole of an object as an image on the film. And when looking at a developed portion of a film used to make the hologram with our ordinary vision, it doesn't look like the image at all. The hologram looks more like a random pattern of swirls or twisting lines.

However, when the hologram is appropriately illuminated with a monochromatic light beam,<sup>62</sup> a wave front is created, and our eyes and brain interpret the light reflected off, or the light transmitted through the hologram, as the undivided wholeness of the three-dimensional object.

The hologram on first inspection does not seem to have an order to it, however, there must be an order since the random pattern of lines and swirls become an image when it is appropriately illuminated. Bohm has called this order *implicit*, from the Latin *implicitus* meaning unexpressed or enfolded. That is, any separated part of the hologram contains an enfolded order like the ones of the image, but it is different nonetheless in shape or visible appearance.

Bohm says this should not be taken metaphorically, but "fairly literally." This point is emphasized by calling the order in the hologram *implicate*. The order on the film will then be unfolded, but when appropriately illuminated, it will be called *explicate*. "The process, in this case wave movement, in which this order is conveyed from object to the hologram will be called *enfoldment* or *implication*. The process in which the order in the hologram becomes manifest to the viewer in an image will be called *unfoldment* or *explication*."<sup>63</sup> Now we ask, how can this holistic understanding be used in our overall worldview. Read on!

Does Bohm's whole-part dialectic take the temporal dimension of holomovement seriously enough? Might there be a future dimension to the implicate whole that requires accounting for? Read on!

## **Toward a Theology of Divine Action in a Holistic and Deterministic Worldview**

The task of the systematic theologian is to construct an internally coherent worldview which is consonant with physical reality as described by the scientist. To seek consonance, we spell out a correspondence between what can be said scientifically about the natural world and what the theologian understands to be God's creation.<sup>64</sup> In this specific case, we ask whether the holistic and determinist interpretation of quantum phenomena of physicist David Bohm is just as forbidding as classical determinism.

In our search for the domain within nature that could host providential divine action, we will not look to hidden variables. Hidden variables merely replace the quantum indeterminism of the Copenhagen school with a form of bottom-up determinism. Within the Bohmian worldview, then, God would have to intervene by abrogating one or more hidden variables to act. God's action would be interventionist. This is something we would like to avoid.

It would be better for the theologian to look at the undivided wholeness of temporal reality for the domain of divine action.<sup>65</sup> Here, God would supervene on all parts including those hidden variables. God's action at the level of the whole, correspondingly, would take the form of top-down or whole-part causation.

Divine action at the level of the whole, we believe, would be welcomed by Bohm himself, even though Bohm was not a theist. Bohm saw redemptive value in holistic determinism. Bohm explained that our English term, *health*, is based on the Anglo-Saxon word, *hale*, meaning whole.<sup>66</sup> The active whole heals what is broken. Based on Bohm's worldview we can see that the whole is the force of healing as well as harmonizing. Divine action at the level of whole-part causation would then be healing, redemptive, salvific.

Further, we recommend a temporal dimension to holism. Other physicists, such as Lee Smolin, see the universe in movement, in evolutionary movement toward a yet to be determined future.

We see a universe evolving from less to more structured, from equilibrium to complexity. This is certainly not the picture a naïve application of the second law of thermodynamics would suggest. The second law says that isolated systems increase their randomness, becoming more disordered and less complex and structured as time moves forward. This is the opposite of what we see happening in the history of our universe, in which complexity increases as structures form on many scales, with the most intricate structures being the most recent. Evolving complexity means time. There has never been a static complex system.<sup>67</sup>

Within the science of physics itself, holism seems to imply if not require temporal movement, advance, and even the evolution of new wholes.

## Holistic Theologies of Divine Action

Would this make sense to a systematic theologian?<sup>68</sup> Yes, indeed. Arthur Peacocke and Nancey Murphy provide examples within theology of holistic accounts of divine action. Peacocke lays a foundation on which Murphy adds superstructure.

“God interacts with the world-as-a-whole,” declares Peacocke.<sup>69</sup> The late Oxford director of the Ian Ramsey Center denies that the world is God's body. Yet, he says, God is omnipresent and omniscient. God is in the world, yet God is more than the world. By acting in the world-as-a-whole, God affects every part in a way that enhances the integrated harmony of all the parts.

If God interacts with the world-system as a totality then God, by affecting its overall state, could be envisaged as being able to exercise influence upon events in the myriad sub-levels of existence of which it is made without abrogating the laws and regularities that specifically apply to them. Moreover, God would be doing this without intervening ... [God's] initial interaction would be expected to be followed by a kind of ‘trickle down’ effect as each level affected by the particular divine intention then has an influence on lower levels and so on down the hierarchies of complexity to the level at which God intends to effect a particular purpose.<sup>70</sup>

According to Peacocke, divine downward causation both guides and heals the ongoing history of the created world. This suggests what we will develop below, namely, the importance of temporality in healing. The future heals the past while uniting what is disparate.

Ontologically, the cosmos is divided temporally by contiguous inertial frames of reference. The creation is divided morally by competition, contravention, and conflict. Will the estranged parts undergo transformation into a new level of harmony? Whereas Bohm's holism fills the spatial present, theological holism relies on a future whole that repairs the brokenness of past parts.<sup>71</sup>

Fuller Seminary's Nancey Murphy is both critical and constructive of Peacocke's process. "Downward causation does *not* in itself provide a solution to the problem of divine action ... .If God is the higher-level agent and the events in the world are the lower-level entities, then the original problem of divine action simply re-appears at this point."<sup>72</sup>

Murphy's critique of Peacocke is that his version of divine action has simply moved interventionism from bottom-up to top-down. Murphy would caution us that a simple top-down causation only re-locates the bottom-up causation of hidden variables. Peacocke's variant risks becoming interventionist.

Murphy's criticism does not seem to be fatal to Peacocke's project. Why? Because direct divine action at the level of the whole leads to indirect effects on the parts such as the selection of potentials that are more rather than less healing. This renders bottom-up actualization of potentials compatible with divine action.

We, Peters and Peterson, add: in the current chapter of cosmic history, there is no single whole of everything. Due to special relativity, the cosmos is an agglomeration of inertial frames of reference each with its own past and future. These frames of reference are contiguous, not integrated. Divine action at the level of the whole would have a uniting if not healing effect, because top-down causation would draw the disparate towards harmony.

Further, the theologian must introduce an eschatological or future-past wholeness that takes us beyond Bohm's universal and present wholeness. We will introduce the necessary temporal component later when we introduce proleptic holism.

## Bohm and Non-Interventionist Divine Action

In the meantime, we will ask whether divine action in Bohm's cosmos can be understood as non-interventionist. Yes, we answer based in part on Nancey Murphy's version of supervenience. How? By including within God's agency a selecting from among the already present natural causes. God is engaged "in the selection of specific lower-level causal processes or powers."<sup>73</sup> By selecting among lower-level causes and powers to act providentially within the creation, no physical laws are violated and there are no causal forces other than the physical. God's action within nature's world remains non-interventionist.

With this finite selection, Murphy does not by any means wish to jettison holism or top-down causation. Top-down causation is observable. After all, we can observe how a conscious human being exhibits top-down causation all day long. If we decide to drink a can of Red Bull energy drink, we might follow that with a half mile swim. Our heart and lungs and legs will feel the physical effects of the subjective decision we made as a person.

Our personhood constitutes a whole, and this whole person exerts downward causation on our thought processes as well as our bodily movements. Our subjective ideas actually do influence the objective world around us. Consciousness and personhood are indisputable realities which demonstrate downward causation. Philip Clayton avers, "I advocate a form of supervenience theory, which holds that mental events are dependent on their physical substrate but are not reducible to them ... . I defend a version of 'weak' supervenience that allows for genuine mental causation; not all causes of human behavior are purely neuronal causes."<sup>74</sup> Here's the point: if we experience top-down causation or supervenience at the human level, then certainly we can imagine top-down causation or supervenience at work in God's relationship to the world.<sup>75</sup>

Theologically, we know that God frequently asks each of us to mediate divine healing through our human agency. So, in our Bohm model of divine action, let us keep holism and downward causation. But, add selection from among potentials.

Murphy's appeal to divine selection among natural causes adds a bottom-up element to the top-down causal mode. In fact, Murphy goes so far as to make room for Robert John Russell's NIODA. Peacocke's top-down causal agency gets complemented by Russell's bottom-up divine action at the subatomic level. God acts both at the level of the smallest part and the largest whole.

Might it be coherent to incorporate both quantum indeterminism replete with bottom-up divine action along with holistic determinism replete with top-down causation into a single coherent account of divine action?<sup>76</sup> And might it be coherent to temporalize the dynamic work of divine action so that eschatological holism heals the brokenness of the past?

But first, should we picture divine action in an incompatibilist or compatibilist frame?

### Incompatibilism versus Compatibilism

At this juncture the systematic theologian comes to a fork in the road and must decide between incompatibilism and compatibilism.<sup>77</sup> Following the incompatibilist branch would require declaring theologically that divine action results in the same level of effects the physicist perceives. Whether the causes are transcendent or immanent, the effects are measurable. Certain behaviors in the physical world would be attributed to God while other behaviors attributed to nature. Not both.

Following the compatibilist branch, on the other hand, would declare that divine action is compatible with deterministic natural processes as described by the physicist. Both voluntary human actions that affect the physical world as well as divine providential guidance are compatible with natural processes, whether those natural processes are exhaustively determined or contingent.

The two authors of this paper, Carl Peterson and Ted Peters, are both Lutheran. Today's Lutherans have inherited a theological principle that largely suggests compatibilism, namely, God works *in, with, and under* natural substances and processes. Divine action *in, with, and under* physical behavior means that nature is graced by God, whether this grace is scientifically observed or not.

For Lutherans, affirmation of the real presence of Christ's body and blood "in, with, and under" the bread and wine of the Eucharist is compatible with the naturalness of bread and wine. Lutherans agree that Christ is present in the elements, but they are suspicious of the metaphysics of transubstantiation as lacking a clear basis in Scripture and so prefer to speak instead of Christ's presence "in, with, and under" (rather than instead of) the bread and wine.<sup>78</sup> Might this notion of "real presence" applied to the sacrament apply also to divine presence within creation as a whole? Yes, indeed.

Lutherans have no patent on compatibilism. Anglican Arthur Peacocke applies this version of compatibilism to divine action in the whole of creation, an insight he draws from the incarnation. Peacocke stresses "the immanence of God in, with, and under the events of the world while nonetheless retaining the ultimate transcendence of God, analogously to the way human persons experience their transcendence over their bodies."<sup>79</sup>

Robert John Russell is more nuanced. Russell is a compatibilist with regard to general divine action but an incompatibilist with regard to special divine action. For Russell, the transcendent source of immanent causation renders God invisible to scientific perception. “Essentially what science describes without reference to God is precisely what God, working invisibly in, with, and through the processes of nature, is accomplishing.”<sup>80</sup> With this in mind, we fly the compatibilist kite and watch where the winds of implication blow it.

### The Options Offered by Kirk Wegter-McNelly

We are not alone. Physicist and theologian Kirk Wegter-McNelly similarly takes the compatibilist branch. But he refines the options.

- A. *Anthropo-physical in/compatibilism*: human freedom is in/compatible with physical determinism.
- B. *Anthropo-theological in/compatibilism*: human freedom is in/compatible with divine determinism.
- C. *Theo-physical in/compatibilism*: objectively special divine action is in/compatible with physical determinism.
- D. *Anthropo-theological compatibilism*: human agency and special divine agency can work together without competing against one another.<sup>81</sup>

According to these distinctions, Robert John Russell’s NIODA fits the theo-physical in/compatibilist option. Or, more precisely, Russell is a theo-physical compatibilist with regard to general divine action but a theo-physical incompatibilist with regard to special divine action.<sup>82</sup>

This is especially relevant because Wegter-McNelly’s account of divine action as bottom-up subatomic action is closely akin to that of Russell. But Russell is an incompatibilist, whereas Wegter-McNelly is a compatibilist.

Following Placher (as well as others such as Karl Barth, Wolfhart Pannenberg, and Ted Peters), I am also persuaded that anthropo-theological compatibilism is a more theologically sound view than anthropo-theological incompatibilism. That is, I think human agency and special divine agency can work together without competing against one another . . . Special divine acts ought not to be construed as closely analogous to and thus in competition with human acts.<sup>83</sup>

Note that Wegter-McNelly calls his own position *anthropo-theological compatibilism*. Perhaps this option will fit the position we are developing here.

Bridging the physics of David Bohm with the holism of Arthur Peacocke and Nancey Murphy and following the compatibilist branch at the fork of the decision path in the road, we will now set our compass toward a rendering of divine action within proleptic theism.

### Introducing Proleptic Theism

In the tradition of St. Thomas Aquinas, we set the task of the systematic theologian as one of showing how all things in reality relate to the one God of grace. A physical theory of

the whole of reality such as we find in David Bohm provides a challenge: might the theologian's constructed worldview be rendered consonant with this interpretation of quantum determinism? Here we will test proleptic theism to see if it fits.

What distinguishes proleptic theism is its emphasis on history as the fundamental ontological category replete with an open and yet-to-be determined future. God's creation will not become a completed whole until its brokenness is healed. That redemption and that whole are eschatological. Creation will be determined to be what it is only in the eschatological consummation.

This promise of eschatological redemption is proleptically incarnated in the Easter resurrection of Jesus Christ. Just as Jesus was raised from the dead, so also will all physical and historical reality be transformed by the new creation yet to come. Retroactively, our present and past will become re-defined by this healing whole, a healing whole that we today anticipate as God's promised future for the cosmos.<sup>84</sup>

The systematic theologian looks first to God's promised future, then retrospectively back to the present and past. Present and past will gain their definition only retroactively. This constitutes the proleptic element in proleptic theism.

Proleptic theism relies on divine grace, on divine determinism. The problem with classical determinism is that all causes could in principle be calculated at the beginning. The world machine, accordingly, is pre-determined by its initial conditions. Perhaps "post-determinism" would better fit the proleptic theist who claims that God is still creating and that only when the creation is redeemed will it be fully created. Only when the world is redeemed will God take a Sabbath rest (Genesis 1:1-2:4a).<sup>85</sup>

The place for contingent acts of nature and free acts of humanity will then find their sanctified place within the healed whole that is God's creation.

## Introducing Eschatological Holism

The very concept of holism implies God, according to theologian Wolfhart Pannenberg. "The concept of the whole as the all-inclusive whole of all finite reality ... becomes an explicit theme for theology whether one wishes it or not."<sup>86</sup> In short, the concept of the whole requires that we ask the God question.

Pannenberg is quick to remind us that the whole is not inclusive of God. God may be responsible for unifying all of finite reality, to be sure. Yet God remains transcendent. God can act on the whole and, thereby, on all of the parts. But God is not stuck within the whole as one finite part among others. "As the unifying unity of the totality of the finite, God is indeed necessarily distinct from it," writes Pannenberg. "Yet at the same time, he is just as necessarily immanent to the world of the finite ... as the continuing condition of its unity."<sup>87</sup>

What physicist Bohm's cosmology lacks but is added by theologian Pannenberg is the temporal power to transform. In fact, according to Pannenberg, the defining reality of every finite creature is determined by the eschatological whole of history. God "remains the future of the whole of the past and keeps present to himself his having been the finite future of every finite present which has now become past. Thus he keeps his past creatures in the present of his future."<sup>88</sup>

The future whole is the power of being that determines the essence of past parts.

God's future is still the creative origin of all things in the contingency of their existence even as it is also the final horizon of the definitive meaning and therefore of the nature of all things and all events. On the path of their history in time objects and people exist only in anticipation of that which they will be in the light of their final future, the advent of God.<sup>89</sup>

This is a deterministic vision. "God is the all-determining reality."<sup>90</sup> Pannenberg's term for this divine determinism is *Bestimmung*, which connotes destiny. Over against classical physics which relies on determinism from past causes, eschatological holism relies on a future determinism. The full quiddity of all finite things will be determined by their destiny.

As finite parts of the inclusive whole that is God's creation, we experience tension, division, and estrangement. Within our daily experience of alienation, we struggle for holistic experience. That is, we search for a prolepsis or anticipation of the future whole of reality yet to come. Can the theologian speak of the future whole acting upon the past parts as healing? As redemptive? Yes. God's eschatological whole which gathers up the entire history of creation will retroactively heal, redeem, and save.

### God's Master Act of Creation

Might proleptic holism be conveyed by another related concept, namely, the concept of the whole of history dubbed *God's master act of creation*? Recall we are looking for consonance between Bohm's holistic determinism and proleptic eschatology. Might those Bohmian holograms become prophecies of a healing whole that we anticipate, not a whole already completed.

As we have seen, the doctrine of holism includes the notion of downward causation—that is, the whole supervenes on the parts. The proleptic theist would add to top-down causation a future-past causation. What we do not find in Bohm is future-whole and past-part holism. So, the theologian may need to step beyond Bohm at this juncture.

The position of proleptic theism begins by applying holistic thinking to God's work of creating and redeeming the world. We suggest describing the whole of cosmic and human history in terms of a single, creative, divine work. We might borrow theologian Gordon Kaufman's phrase, here, "master act."<sup>91</sup> God's primary action is the divine master act by which God creates and consummates the whole cosmos.

En route to the completion of this work God engages in many sub-acts (corresponding to Bohm's notion of sub-totalities?), of course. A homemaker, for example, may bake an apple pie. The baked pie is the master act. But en route to completion the baker must perform certain sub-acts such as gathering the ingredients, stirring together the apple slices with lemon juice, sugar and cinnamon. Then pour the resulting mixture into the pie shell, baking, removing the pie from the oven at the proper time, cleaning up, and so forth. There is one master act, but it incorporates numerous sub-acts, all of which can be identified by their contribution to the purpose of bringing a delicious pie into existence.

There is no apple pie—no whole—until the creative work is completed. So also, God's act in the form of top-down causation—perhaps future-past causation—consists in a purposive event of creation that will not become an event of its own until its completion, until the eschatological consummation. Viewed strictly from our present perspective, there is no whole of all things. The uniting and determining whole—the new creation—is yet to come.

This leads into an intriguing paradox: knowledge of God's sub-acts depends upon prior knowledge of God's master act. But the master act is not yet complete. To be able to discern an event to be a sub-act within the divine master act would require having the eschatological completion in sight.

Is it possible to have the end—the finalé—revealed ahead of time? Yes indeed! The creator of the world has revealed to us that there is a purpose, which is being brought toward fulfillment. This purpose can be discerned in the ministry, death, and resurrection of Jesus Christ. In Jesus Christ we see proleptically God's intention for the whole, God's single purpose that runs from alpha to omega, from beginning to end. "For in him all things in heaven and on earth were created, things visible and invisible. . . . He himself is before all things, and in him all things hold together" (Col. 1:16-17).

Hence, we may think of the whole of cosmic history as a single divine act of creation, and our own personal histories are a small, but *indispensable* parts of that whole. Just as the operations of the human heart are drawn up into the decisions and purposes of the human personality as a whole, individuals' personal lives will be drawn up into and find their proper definition through their relationship to the whole of God's creative work.

But because God's creative history has not yet come to its completion, it is not yet whole. The future is still open. Reality is on the way to being determined and defined in mutual reciprocity between the actual course of finite events and the overall divine design. The promise of the future completion of God's master act permits us to think holistically in anticipation. In the meantime, we find ourselves within the creative work of God, a work yet to be completed, and hence appropriately called from our point of view "continuing creation."

## Conclusion

Our treatment of Bohmian determinism takes one step toward constructing a comprehensive yet coherent theological worldview that is consonant with the natural order as viewed by the physicist. We opened by asking whether a theology of divine action within nature's world could be rendered consonant with *classical determinism* as plied by Newtonian mechanics. We answered negatively. We then asked about *quantum indeterminism* as plied by Niels Bohr and Werner Heisenberg. We answered affirmatively with special attention to the progressive research program of Robert John Russell. Then we turned to *holistic determinism* as plied by David Bohm. Our answer is a firm *maybe*. Like trying on a new baseball cap to see if it fits, we measured it against proleptic theism.

Did we adequately clarify the *maybe* by introducing the concept of proleptic theism, with its attention to history as the fundamental ontological category? We work here with a reverse ontology, so to speak, by locating the healing whole in the future rather than in the past or in timeless eternity. Therefore, the first thing God gave to the world was a future, a whole future. God is still gracing the creation with a future that is both open to new things and to a consummate whole of meaning and being.<sup>92</sup>

We borrowed Wolfhart Pannenberg's eschatological holism and Gordon Kaufman's phrase, "master act," to express the wholeness by which God creates and consummates the cosmos. En route to the master act, God uses numerous contingent sub-acts. The master act will not become an event by itself until the completion of all the sub-acts; that is, until the eschatological consummation.

That eschatological consummation whereby current open histories are rendered a single whole does not require waiting for the future. Eschatological wholeness is as close to us right now as the next moment is. God's healing power approaches the present moment—every explicate moment—with implicate wholeness as proleptic anticipation. We experience wholeness in the form of promise.

Our prolepticism requires the theologian to add an element not already within Bohm, namely, temporal holism. Bohm's holism is spatial, universal, and co-present. Proleptic holism imparts a temporal dimension to flesh out the healing effect of top-down and even future-past holomovement. The temporal augment renders holism redemptive. This means our theological construction is partially consonant though not exhaustively consonant with Bohmian physics.

We argue that Bohmian determinism implies a yet to be completed whole to justify the healing claim. This makes Bohm's determinism different from Newtonian determinism. For classical physics, all effects are determined by past causes. But for our slightly modified Bohmian worldview, explicate effects are determined by an implicate order yet to become a whole. This renders the present explicate moment contingent, open, and anticipatory. Accordingly, the future can differ from the present and past. This opens the Bohmian worldview to an eschatological augment of the type we propose in this article.

Yes! Bohm's *implicate order* is a holistic deterministic theory. We wish to assert theologically that it is a theory abstracted from the ongoing creative work of God, a work yet to be completed. The world process is on-going, yet to be discovered within God's continuing creation.

## Notes

1. "I call this type of divine action *non-interventionist view of objective special providence or non-interventionist objective divine action* (NIODA)." Robert John Russell, *Cosmology from Alpha to Omega: The Creative Mutual Interaction of Theology and Science* (Minneapolis MN: Fortress, 2008), 117.
2. Russell sees consonance between the theologian's vision of divine action with many sciences, not only quantum indeterminism. "My thesis is that ... today, because of changes in the natural sciences, including quantum physics, genetics, evolution, and the mind/brain problem, and because of changes in philosophy, including whole/part and top/down analysis, we can now understand special providence as the objective acts of God in nature and history and we can understand these acts in a non-interventionist manner consistent with science." Robert John Russell, "Does the 'God Who Acts' Really Act in Nature?" in *Science and Theology: The New Consonance*, ed. Ted Peters (New York: Harper, Westview, 1998), 77–102, at 79.
3. Is our task worthwhile despite the prevalence of quantum quackery? Yes, would be the answer offered by Mark Harris, Andreas Idreos Professor of Science and Religion at the University of Oxford. "We need to supplement the scientific method with a further methodology that is equipped to take religious, ethical, and aesthetic convictions about reality seriously, all the while treating the science respectfully and responsibly. Any claim about what is most fundamental to our existence will automatically have religious and ethical implications, since questions concerning human flourishing—by which I mean the growing into mature realization of our deepest-held values and purposes—come into focus, questions that cannot be answered empirically even if they first arise from empirical quantum physics. Is there a methodology that can handle all these weighty demands? Happily, there is just such a methodology at hand. It is called science and religion" (Harris, 2024, 605).

4. This paragraph is a variation of one taken from, *Extraterrestrial Intelligence: Academic and Societal Implications*, Edited by Jensine Andresen and Octavio A. Chon Torres, Cambridge Scholars Publishing, March 2022, Ch. 17 by Carl Peterson, 269.
5. “We may regard the present state of the universe as the effect of its past and the cause of its future. An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed, if this intellect were also vast enough to submit these data to analysis, it would embrace in a single formula the movements of the greatest bodies of the universe and those of the tiniest atom; for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes.” Pierre-Simon LaPlace, *A Philosophical Essay on Probabilities* (1814).
6. “The world revealed by quantum theory is consonant with what would be expected on the basis of Christian doctrine.” Rodney D. Holder, “Quantum Theory and Theology,” in *The Blackwell Companion to Science and Christianity*, eds. J.B. Stump and Alan G. Padgett (Oxford: Wiley Blackwell, 2012) 220–230, at 229.
7. One might expect Oxford’s Richard Dawkins to criticize quantum quackery. He derisively treats philosophical and theological extrapolations on the mathematical formulae of quantum mechanics. “Some physicists resort to a vast number of parallel but mutually unreachable worlds that proliferate to accommodate every alternative quantum event. Other physicists, equally desperate, suggest that quantum events are determined retrospectively by our decision to examine their consequences ... .In the face of these profound and sublime mysteries, the low-grade intellectual poodling of pseudophilosophical poseurs seems unworthy of adult attention.” Richard Dawkins, “Hall of Mirrors,” *Forbes* (October 2, 2000) 1–3, at 3.
8. The difference between everyday sense experience and what happens at the quantum level becomes the difference between illusion and reality for progressive theologian Keith Giles. Giles promulgates a Christianized version of ancient gnostic non-dualism (*Advaita* in Hinduism). Accordingly, all things are only one thing. Our spiritual practice is aimed at realizing how your or my self is itself God as well as all things in reality. Oneness is real. Duality is unreal. At the quantum level, there is only one field of reality. At the quantum level we find God, unity, and oneness. “The natural way of thinking is immersed in the illusion of separation. Our world appears to us to be filled with separate bodies and inhabited by different people who are all unique and individual from one another. But Jesus—and Quantum Science—tells us otherwise. We know that Jesus wants us to see reality as it is and embrace the interconnectedness of all things. Quantum physics tells us that everything we see and experience—no matter how separate and unique these may seem—are, in reality, all manifestations of the one quantum field. In fact, everything is an expression of the quantum field” (Giles, 2024, 249). For Giles, a single universal quantum field is itself God. And it is you and me as well. This is not the position taken by Robert John Russell.
9. Quantum quackery has become a genre. Is quantum theology a field with intellectual integrity? Blogger Nick Spencer takes the affirmative. But within the limits of language rather than ontology. “To talk of Quantum Theology is to invite nonsense and then ridicule ... .[Even so, to] talk about the quantum world can illuminate some of the challenges we face when trying to talk about God ... .Quantum phenomena are not comprehensively captured by particles and waves, or by the idea of information (as we understand it) but there is enough in what they ‘do’ to mean such descriptions are at least helpful. Similarly, God is not exhausted by being described as a king, father or mother but there is enough in those analogies to merit their use.” Nick Spencer, “Quantum Theology,” *Theos* (2018) <https://www.theosthinktank.co.uk/comment/2018/09/14/quantum-theology>.
10. Robert John Russell, “Challenges and Progress in ‘Theology and Science’,” in *Scientific Perspectives on Divine Action: Twenty Years of Challenge and Progress*, eds. Robert John Russell, Nancey Murphy, William R. Stoeger, S.J. (Vatican City State: Vatican Observatory Publications, 2008), 3–56, at 21.
11. Because of the ongoing debate between the Copenhagen and Bohm interpretations, “NIODA, in so far as i relies on the Copenhagen interpretation, could be seen as resting

- on shaky ground” concludes Emily Qureshi-Hurst. Emily Qureshi-Hurst, “Does God Act in the Quantum World? A Critical Engagement with Robert John Russell,” *Theology and Science* 21, no. 1 (2024): 106–121, at 111.
12. This letter to Max Born in 1926 conveys that message. Einstein wrote: “The [quantum] theory yields much, but it hardly brings us close to the secrets of the Ancient One. In any case, I am convinced that He does not play dice.”
  13. Jearl Walker, *Fundamentals of Physics* (Hoboken, NJ: John Wiley & Sons, Inc. 2008), 740.
  14. Niels Bohr, *Philosophical Magazine* (1913).
  15. Martin J. Klein, *Physics in Perspective*, 12 (2010), 307–337.
  16. Louisa Gilder, *The Age of Entanglement: When quantum physics was Reborn* (New York: Vintage Books, 2008), xvii.
  17. Items I, 2 and 3 in this paragraph were taken from David Bohm, *Quantum Theory* (New York: Dover Publications, 1989, an unaltered replication of his Englewood Cliffs, N.J.; Prentice-Hall, Inc, publication, 1951). The material is not necessarily a direct quote but our paraphrase of it and is given on iii.
  18. 1927 Fifth Solvay International Conference on electrons and photons: known as the conference to be if you were involved in the development of quantum mechanics. Considered the most notable and the conference that was the turning point in physics. Einstein’s “measurement problem” remains not adequately solved. The International Solvay Institutes for Physics and Chemistry is located in Brussels, Belgium and was founded by the Belgian Industrialist Ernest Solvay in 1912.
  19. See footnote 10, the story of what happened at Solvay between Einstein and Bohr is given on 110–114 of Bohm, *Quantum Theory*.
  20. *Ibid.* 111. This concern is ongoing today as not being solved, since physicists haven’t, in mass, accepted the solution presented by a number of theoreticians, such as David Bohm, to erase the “measurement problem” or “collapse of the wavefunction” terminology, although “collapse” is being used less and less.
  21. *Ibid.* 112.
  22. *Ibid.* 123–127 provides the story of events at the 1930 Solvay Conference.
  23. Albert Einstein, Boris Podolsky, and Nathan Rosen, “Can Quantum Mechanical Description of Reality be Considered Complete?” *Physical Review* 47, no. 10 (1935): 777–780. EPR is the initialism for the last names of the authors of the paper: Albert Einstein, Boris Podolsky and Nathan Rosen. They published the paper as a challenge to the completeness of quantum mechanics, but it gave the physics world and the general public far more. Their paradoxical concept has been proven not to be tenable in the quantum world. But Einstein holding on to the belief that the quantum world is objective and deterministic, it seems, maybe correct as Bohm has shown with his different interpretation of the quantum world.
  24. EPR, 778.
  25. Niels Bohr, “Can Quantum Mechanical Description of Physical Reality be Considered Complete?” *Physical Review* 48, no. 8 (1935): 696–702.
  26. D. Bohm and B. J. Hiley, *The Undivided Universe: An Ontological interpretation of Quantum Theory* (London: Routledge: 1993), 137. The Italics in the quote are the authors, also the that is, the Newtonian paradigm.
  27. Bohm, *Quantum Theory*; Prentice-Hall, Inc; Englewood Cliffs, N.J., 1951; also available in an unabridged and unaltered republication by Dover Publications, Inc., New York, 1989.
  28. It is Russell’s opinion that the determinism of David Bohm belongs in the same category as that of Newtonian mechanics. “David Bohm’s interpretation offers an empirically valid deterministic alternative . . . This world is one in which everything, including the future, is determined. Such a world is reminiscent of Newton’s idea of space as the divine sensorium.” Robert John Russell, “Challenge and Progress in ‘Theology and Science’,” in *Scientific Perspectives on Divine Action: Twenty Years of Challenge and Progress*, eds. Robert John Russell, Nancey Murphy and William R. Stoeger, S.J., (Vatican City State: Vatican Observatory Publications, 2008), 3–56, at 39. Perhaps Russell’s view would obtain if Bohm’s determinism relied solely on hidden variables. But, when we turn to the deterministic influence of

- whole-part causation, something different happens. The natural world becomes a holomovement replete with contingency, unpredictability, and history. Does this suggest that Bohm's holistic model is open to divine action in a way that the classical model was not?
29. David Bohm, "A Suggested Interpretation of the Quantum Theory in Terms of Hidden Variables, I and II," *Physical Review* 85 (1952): 166–193.
  30. Yes! According to a proof given by J. von Neumann in *Mathematische Grundlagen der Quantenmechanik*, (Berlin: Verlag Julius-Springer, 1932), [English Translation: Princeton University Press, 1955].
  31. If one makes the WKB (Wentzel-Kramers-Brillouin) approximation by setting  $\hbar = 0$ , in the motion of the phase trajectory of the Schrödinger equation, it becomes equivalent to the standard classical Hamilton-Jacobi (HJ) equation, which represents a particle with momentum  $\mathbf{p}$ , which moves normal to the wave front  $S = \text{constant}$ . Bohm did not in his calculations make this approximation, and considered the term as an additional potential in the quantum domain, and the equation with the additional potential the quantum Hamilton-Jacobi equation (QHJ). The term provides additional ontological structure to the quantum domain studied via the Schrödinger equation with the classical and quantum potential appearing fundamentally in comparable conditions.
  32. The amplitude,  $R$ , is the magnitude of maximum displacement of the elements from their equilibrium positions as the wave sweeps through them. The phase,  $S$ , is the argument in the exponential of the wavefunction that sweeps through an element at a given position, which changes linearly with time.
  33. Footnote 21, Chapter 12 for the WKB approximation, 192 for understanding the conservation equation in general.
  34. Footnote 20, 29 and 30 in connection with 192 given in footnote 27.
  35. E. Schrödinger, "Discussion of Probability Relations between Separated Systems," *Proceedings of the Cambridge Philosophical Society*, 31 (1935): 555–563.
  36. Even at this late date, September 2023, *entanglement in quantum theory* gets confused. We want to at least let the readers know what is entangled and avoid some of the confusion. Particles, waves and fields are not entangled. To simplify, particles are excitations of the quantum field, which are in quantum states. The quantum states are what are entangled. And yes, Ernest L. Simmons Book: *The Entangled Trinity: Quantum Physics and Theology* is an appropriate metaphor for the conundrum of God who is mutually Three in One.
  37. Gilder, *The Age of Entanglement*, 233–249. These pages present an exposition of John S. Bell and his two papers.
  38. John S. Bell, "On The Einstein Podolsky Rosen Paradox," *Physics*, 1 (1964): 195–200.
  39. John S. Bell, "On the Problem of Hidden Variables in Quantum Mechanics," *Reviews of Modern Physics*, 38 (1966): 447–452.
  40. Ibid. Reference and Endnotes 2.
  41. Footnote 23.
  42. Casey Cheng, *Towards Data Science*, March 21, 2022.
  43. Bohm contrasts this with classical waves which act mechanically (transfers energy and momentum to push floating objects), always produce effects that are . . .proportional to the strength of the wave. Footnote 20, 31.
  44. Footnote 20, 62.
  45. Ibid., 62.
  46. Footnote 33. By Lorentz invariant is meant having the benefit of properties being unchanged regardless of changes in the conditions of measurement, therefore, invariance is related to conservation laws in physics, but Lorentz invariance is limited at distances where effects of curvature are appreciable, such as with distant systems, which validates Bell's statement.
  47. J.M. Jauch and C. Piron, *Helvetica Physica Acta*, 36 (1963): 827.
  48. A. M. Gleason, *Journal of Mathematics and Mechanics*, 6 (1957): 885.
  49. Footnote 33. By not fully using the postulates and, thereby notations in quantum mechanics, he made an error in reasoning for his impossibility proof. Further quotes in the discussion given here are those from Bell's paper.

50. Von Neumann was aiming to prove that this requirement being true for quantum mechanical states also holds for theoretical dispersion free states as well; that is  $\langle A \rangle + \langle B \rangle = \langle A + B \rangle$  holds for both quantum mechanical states and the theoretical dispersion free states. In this depiction  $\langle A \rangle$  etc. represents the expectation values of the operator. Bell demonstrated that this requirement does not hold. It was proven that theoretical dispersion free states do not have additive values like quantum mechanical states.
51. Footnote 24. Von Neumann's influential book treated many of the concerns in quantum theory and its description of the state of the system provided by the wavefunction. We touched on its one error.
52. David Bohm, *Wholeness and the Implicate Order* (London: Routledge, 1995), ix. There are a number of reprints. The one we are using was reprinted in 1995.
53. *Ibid*, 11.
54. Footnote 20, 351. The italics are the authors.
55. Bohm, *Wholeness and the Implicate Order*, 112. This phrase was used in his discussion on concepts of order in the sense that we used it here.
56. Footnote 3.
57. Footnote 46, 122–139. These pages explain the contradiction in continuity, causality and locality between relativity and quantum theory, as well as their commonality of undivided wholeness although achieved differently by the theories.
58. Bohm obtained his next step from his question in footnote 20, 353! *By giving attention to similar differences and different similarities* from Footnote 46, 115–116. Bohm indicates in chapter 5, notes 1, that he received this concept of *order* in a private communication from the well-known artist, C. Biederman.
59. Footnote 20, 353.
60. Footnote 20, 353.
61. *Ibid*.
62. A monochromatic light beam is one that has only one wavelength: lasers are used for this purpose.
63. Footnote 20, 354.
64. See: Ernan McMullin, "How Should Cosmology Relate to Theology," in *The Sciences and Theology in the Twentieth Century*, ed. Arthur R. Peacocke (Notre Dame IN: University of Notre Dame Press, 1981), 39; and Ted Peters, ed., *Science and Theology: The New Consonance* (New York: Harper, Westview, 1998).
65. Villanova theologian Ilia Delio incorporates the physics of David Bohm into her doctrines of God and creation. "Something invisible, in other words, continually gives rise to the whole of space-time, and to everything that exists in space-time. The implicate order is not a material order because it exists outside the three dimensions of space and outside time." Ilia Delio, *The Not-Yet-God: Carl Jung, Teilhard de Chardin, and the Relational Whole* (Maryknoll NY: Orbis, 2023), 47–48. On the one hand, the physical universe continually gives rise to new wholeness. That is, the whole of the universe is changing, temporal, historical. On the other hand, the oneness of the whole is externally determined by that which exists extra-temporally, "outside the three dimensions of space and outside time." Might that be God?
66. Bohm, *Wholeness and the Implicate Order* (1995), 3. At least one theologian, the late John Polkinghorne, appropriates quantum holism into the doctrine of creation. The cosmos is "an integrated world, whose deep intelligibility and consistency is a manifestation of the divine Word that lets be the whole of created reality (Genesis1: And God said 'Let there be ...')." John Polkinghorne, *Quantum Physics and Theology: An Unexpected Kinship* (New Haven and London: Yale University Press, 2007), 109.
67. Lee Smolin, *Time Reborn: From the Crisis in Physics to the Future of the Universe* (Boston, Massachusetts: Mariner Books, 2014), 221–222.
68. Mark Harris warns us about *quantum quackery*. This quantum quackery derives from *quantum fundamentalism*. "Quantum fundamentalism is the belief that quantum physics captures what is most fundamental in our physical world, even though we might be blissfully unaware of this in our

- daily lives” (Harris, 2024, 596). Harris also grants us *theological liberty* to choose between scientific interpretations of QM. This sheds doubt on the presupposition that QM is itself the final map of reality. “The science has given us freedom to choose between the interpretations but no liberty to make an informed decision. To put it bluntly, quantum fundamentalism may claim massive scientific support, but if it cannot help us to make human sense of the science, then what earthly good is it as a worldview?” (Harris, 2024, 601).
69. Arthur Peacocke, “God’s Interaction with the World: The Implications of Deterministic Chaos and of Interconnected and Interdependent Complexity,” in *Chaos and Complexity: Scientific Perspectives on Divine Action*, eds. Robert John Russell, Nancey Murphy and Arthur R. Peacocke (Vatican City State: Vatican Observatory Publications, 1995), 263–288, at 282.
  70. Arthur Peacocke, “Reflections on ‘Scientific Perspectives on Divine Action’,” in *Scientific Perspectives on Divine Action: Twenty Years of Challenge and Progress*, eds. Robert John Russell, Nancey Murphy, and William R. Stoeger, S.J., (Vatican City State: Vatican Observatory Publications, 2008), 201–224, at 220. “If God interacts with the world at a supervenient level of totality, then God, by affecting the state of the world-as-a-whole, could, on the model of whole-part constraint relationships in complex systems, be envisaged as able to exercise constraints upon events in the myriad sub-levels of existence that constitute that world without abrogating the laws and regularities that specifically pertain them—and this without intervening ... *Particular* events might occur in the world and be what they are because God intends them to be so, without at any point any contravention of the laws of physics, biology, psychology, sociology, or whatever is the pertinent science for the level of description in question” *Ibid.*, 283.
  71. Bohm himself does not include the work of the future whole. The systematic theologian must go beyond Bohm’s physics to hyperphysics or even metaphysics. Teilhard de Chardin made a move like ours here. He used the term, *hyperphysics*, to identify the move beyond the empirical to the philosophical. For Teilhard, the final future with holistic healing is Point Omega. “Omega is the principle we needed to explain both the steady advance of things toward more consciousness and the paradoxical solidity of what is most fragile ... Something in the cosmos, therefore, escapes entropy—and does so more and more.” Pierre Teilhard de Chardin, *The Human Phenomenon* (Brighten: Sussex Academic Press, 2015), 193. Robert Nicastro puts in a way that fits our agenda here. “What drives evolution more than anything else is the allurement of an open-ended future, a future that is actively present at every moment.” Robert Nicastro, *The Future as Sole Support: Metaphysics, Hyperphysics, and the Theology of Teilhard de Chardin* (Unpublished Ph.D. dissertation, Villanova University, 2025), 129.
  72. Nancey Murphy, “Emergence, Downward Causation, and Divine Action,” in *Scientific Perspectives on Divine Action: Twenty Years of Challenge and Progress*, eds. Robert John Russell, Nancey Murphy, and William R. Stoeger, S.J. (Vatican City State: Vatican Observatory Publications, 2008), 111–132, at 128, italics in original.
  73. *Ibid.*, 129.
  74. Philip Clayton, “Neuroscience, the Human Person, and God,” in *Bridging Science and Religion*, eds. Ted Peters, Gaymon Bennett and Kang Phee Seng (London: SCM Press, 2002), 107–120, at 108.
  75. Three Iranian Islamic scholars draw on David Bohm in concert with Avicenna (Ibn Sina 980-1037) to enlist top-down causation to describe the causal relationship of the mind to the brain. “One of the consequences of this [Avicenna-Bohm] theory is the guidance role of the mind and its top-down effect on the brain and body, so that conscious will affects the brain in a hierarchical manner along with physical factors and without violating the physical laws.” Hamid Faghanpour Azizi, Mehdi Golshani, and Kouroush Nozari, “Foundations of Quantum Approaches to Consciousness,” *The Quarterly Journal of Philosophical Investigations* 15, no. 36 (Autumn 2021): 151–170, at 162.
  76. Theologian Rodney D. Holder employs the principle of analogy to demonstrate consonance between quantum holism and theological holism. “According to Christian doctrine, God is fundamentally relational. God is one, yet God is also Trinity ... Quantum holism, as

- demonstrated by the EPR thought experiment, is analogous to this. The electron and positron, though distinct and widely separated, yet form a unified quantum system.” Holder, “Quantum Theory and Theology,” 229.
77. The distinction between incompatibilism and compatibilism (soft determinism) is typically made in debates regarding human free will in an otherwise determined physical universe. Compatibilism is commonly defined as the belief that free will and determinism are mutually compatible, and that one can believe in both without being inconsistent. In the present discussion, divine action in nature’s world replaces human free will as one term in the debate.
  78. Ian A. McFarland, *From Nothing: A Theology of Creation* (Louisville KY: Westminster John Knox, 2014), 174–175. “In, with, and under” suggests but does not require compatibilism. The Roman Catholic notion of transubstantiation—wherein the substance of bread and wine are transubstantiated so that they become the body and blood of Jesus Christ—requires incompatibilism within Thomistic metaphysics. The Reformation position was that transubstantiation says too much. “In, with, and under” affirms the physical presence of the body and blood in the Sacrament of the Altar, but it stops short of providing either a metaphysical or scientific explanation.
  79. Arthur Peacocke, *All That Is: A Naturalistic Faith for the Twenty-First Century* (Minneapolis: Fortress Press, 2007), 23, italics added.
  80. Robert John Russell, *Cosmology from Alpha to Omega: The Creative Mutual Interaction of Theology and Science* (Minneapolis: Fortress Press, 2008), 214.
  81. Kirk Wegter-McNelly, “Does God Need Room to Act? Theo-Physical In/Compatibilism and Noninterventionist Theories of Objectively Special Divine Action,” in *Scientific Perspectives on Divine Action: Twenty Years of Challenge and Progress*, eds. Robert John Russell, Nancy Murphy and William R. Stoeger, S.J., (Vatican City State: Vatican Observatory Publications, 2008), 299–314, at 306.
  82. *Ibid.*, 306.
  83. *Ibid.*, 306.
  84. Borrowing from Alexander Wendt’s social theory along with Walter Wink’s biblical exegesis of the principalities and powers, sociologist Robert Lee constructs a quantum theology that includes a retroactive ontology. “History is not just a sequence of separate events, but events that are internally related to each other, making the meaning of what happened yesterday dependent on what happens today—not just in terms of our descriptions of the past—but, in certain respects,” defining them as they actually were (R. Lee 2023, 485). Robert Lee, “Pauline Principalities and Quantum Structures: A Match Made in Heaven,” *Theology and Science* 23, no. 3 (2024): 471–490, at 485.
  85. Sean Luke at Trinity Evangelical Divinity School would place creation’s consummation in the category of Special Divine Action (SDA) rather than General Divine Action (GDA). Redemption of creation requires SDA. SDA actualizes God’s *laws of grace*. “Laws of grace, as opposed to laws of nature, describe actualizations of potencies manifest as miraculous behaviors in relation to God’s effectual call. In other words, God has built into natural physical entities certain potencies which are only actualized in relation to his effectual call. God’s effectual call, then, is a call distinct from that which God generally issues in God’s activity of concurrence.” Sean Luke, “A Deepest Dearest Freshness: Special Divine Action and the Eschatological Transformation of the Cosmos,” *Theology and Science* 22, no. 4 (2024): 8; <https://www.tandfonline.com/doi/full/10.1080/14746700.2024.2436787?src=exp-la>. God’s raising of the dead belongs within the category of the laws of grace. Let us grant this. But, one might then ask: why not place these transforming laws of grace already within creation, within GDA?
  86. Wolfhart Pannenberg, *Metaphysics and the Idea of God*, tr. Philip Clayton (Grand Rapids MI: Eerdmans, 1990), 142.
  87. *Ibid.*, 143.
  88. Wolfhart Pannenberg, *Theology and the Kingdom of God* (Louisville KY: Westminster John Knox, 1969), 63.
  89. Wolfhart Pannenberg, *Systematic Theology*, tr. by Geoffrey W. Bromiley, 3 Volumes (Grand Rapids MI: Wm. B. Eerdmans, 1991–1998), 3:531. When arguing against Wolfhart

Pannenberg's version of eschatological wholeness, Sang Hoon Lee fears that an eschatological whole-part causation would constitute an unnecessary detour from temporal top-down causation. Lee says, "divine eternity as the totality can engage with history directly at any point of time, without a detour via the eschaton." Sang Hoon Lee, "Eternity and the Future: a Critique of the Plotinian Myth in Pannenberg's Theology," *International Journal of Systematic Theology* 22, no. 2 (2 April 2020): 145–281; doi:10.1111/ijst.12409. Most challenging is Lee's contention that "The temporal wholeness is impossible and always lies beyond even in the final eschatological future" (Ibid., 230). It is our view that eschatological wholeness is determined by God. Wholeness is as close to us right now as the next moment is. What makes it eschatological is the dimension of healing that imbues its wholeness, a healing that is co-present with our brokenness. Eschatological wholeness is not a detour, nor must we wait for it's influence on the present moment.

90. Pannenberg, *Systematic Theology*, 1:159.
91. Gordon Kaufman, *God the Problem* (Cambridge, Mass.: Harvard University Press, 1972), 137. For a similar position see Wolfhart Pannenberg, *Toward a Theology of Nature: Essays on Science and Faith*, ed. Ted Peters (Louisville: Westminster/John Knox, 1993).
92. This sentence is a paraphrase of a sentence from Ted Peters' book, *God—The Worlds Future: Systematic Theology for a New Era--[Rev]*, 2nd ed. Copyright @ 2000 Fortress Press.

## Disclosure Statement

No potential conflict of interest was reported by the author(s).

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