The Experiential Basis of Wave-Particle Duality, Quantum Uncertainty, the Creation and Collapse of the Wave Function, and Quantum Nonlocality

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ABSTRACT

In this work a very simple model of physical experiential creation is developed and then used to provide a single, consistent, and clear solution to the riddles posed by the phenomena that lie at the heart of quantum physics. By providing a unitary framework for understanding all of these heretofore inexplicable phenomena, this model demonstrates that physical reality is a reality that has to be created in order to be known. What this model also demonstrates is that the way in which physical reality is created is through a specific type of relation that takes place at a level of reality that is more fundamental than the physical level of reality. Understanding that physical reality has to be created in order to be known first makes it possible to recognize the experiential mechanism that produces wave-particle duality. Recognizing that experiential mechanism then makes it possible to identify and define the fundamental limitation that exists in the creation of physical experience that produces quantum uncertainty. Following that, that same experiential mechanism and limitation is then used to explain both the creation and collapse of the wave function, as well as quantum nonlocality. Ultimately, this model of physical experiential creation, by providing a single solution to all of these heretofore insoluble riddles, allows for the unification of classical and quantum physical experiential reality, by demonstrating that the only difference between determinate classical physical reality and indeterminate quantum physical reality lies in the relational conditions under which each of these physical experiential realities is created. What this model also makes clear is that the probability or randomness that is so much a part of quantum theory is not an actual feature of reality, but is only an artifact of the process by which quantum physical reality is created, thereby vindicating Einstein for his never-relinquished view that reality is not fundamentally probabilistic.

Key Words: Wave-particle Duality, Uncertainty, Wave Function, Nonlocality, Experience, Reality, Complementarity, Quantum Physics

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Introduction

Nearly one-hundred years since the discovery of the two phenomena that led to the development of quantum physics, i.e., wave-particle duality and quantum uncertainty, no mechanism has as yet been identified to account for these two phenomena, although many mechanisms have been proposed. Many of the mechanisms proposed rely on the assumption of physical realism, which is the assumption that what we experience as physical reality exists as it is observed to exist in the absence of its observation, and that the act of observation simply reveals what is already there.

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However, as noted by some researchers, quantum physics poses a significant challenge to this assumption. "Physical realism suggests that the results of observations are a consequence of properties carried by physical systems. It remains surprising that this tenet is very little challenged, as its significance goes far beyond science. Quantum physics, however, questions this concept in a very deep way" (Gröblacher *et al*., 2007).

What this work will demonstrate is that science needs to set aside the assumption of physical realism if it is to understand how the phenomena of both wave-particle duality and quantum uncertainty are produced. Specifically, what needs to be set aside is the idea that what we experience and observe as physical reality is a reality that exists independent of our observation. In fact, what this work will demonstrate is that once the assumption of physical realism is set aside, so that what we experience as physical reality can then be described as a reality that has to be created through an act of observation, the heretofore inexplicable phenomena that lie at the heart of quantum physics, i.e., wave-particle duality, quantum uncertainty, the creation and collapse of the wave function, and quantum nonlocality, all become relatively easy to explain and understand. Additionally, understanding physical reality to be a reality that has to be created through an act of observation makes it possible to identify a truly objective level of reality—i.e., a level of reality that actually exists independent of the act of observation—that is more fundamental than what we experience as physical reality.

Science needs an objective reality in order to function. That is, in order for science to function, there has to be a reality that is as it is regardless of whether or not that reality is part of an observational system. And such a reality does exist; it's just that physical reality is not that objective reality. That is, there is a reality that exists independent of observation, but what we experience and observe as physical reality is not that reality. Rather, the reality that actually exists independent of observation is the more fundamental reality that, through a specific type of relation to itself, creates whatever it is that we experience and observe as a physical reality, which includes both determinate classical physical reality as well as indeterminate quantum physical reality.

Despite the fact that the long-ago discovered phenomenon of wave-particle duality makes it somewhat obvious that what we experience as physical reality likely does not exist independent of observation but is more likely being in some way created by the act of observation, science nonetheless continues to resist letting go of the assumption that physical reality has an existence that is independent of observation. And this resistance is quite natural, inasmuch as science has no other seemingly objective reality to work with, other than physical reality. That is, because science needs there to be an objective reality in order to function, and because physical reality is the only reality that it has, science has been compelled to continue to treat physical reality as if it were truly objective, even though, as already noted, that assumption has been clearly called into question by quantum physics. In this way, the relation of science to physical reality, since the advent of quantum physics, is to some degree like that of someone who feels compelled to remain in an unhappy relationship for no reason other than the lack of a suitable replacement.

That having been said, one goal of this work is to introduce science to a reality, other than physical reality, that can serve as the objective reality that science needs in order to function, so that science can finally feel secure enough to move on from what has become its somewhat dysfunctional relation with physical reality. Because once the relatively simple experiential mechanism that produces all physical experience is understood, not only does it become clear that physical reality is not the objective reality that we thought it was, but it also becomes clear that there is a more fundamental reality that underlies physical reality that is truly objective, i.e., that exists independent of observation. And the evidence that there is a more fundamental and truly objective reality that underlies physical reality will be found in the fact that, in the context of this more fundamental and truly objective reality, the basis of the heretofore inexplicable phenomena that lie at the heart of quantum physics not only cease to be inexplicable, but instead become somewhat obvious.

Methods

The underlying actuality

In order to understand the mechanism that produces wave-particle duality, quantum uncertainty, and physical experience in general, it

is necessary to introduce into this discussion a truly objective reality that underlies what we experience as physical reality. This truly objective reality, which underlies physical reality as water underlies a reflection that rests on its surface, is as it is, regardless of whether or not it is involved in a relation that is producing what we experience as a physical reality. That is, this underlying and truly objective reality may, through relation to itself, produce what we experience as physical reality, but its essential nature is not altered in any way as a result of its involvement in the specific type of relation with itself that produces a physical experience or observation. This underlying and truly objective reality is not itself a physical reality, because it is not an experiential reality. Rather, this underlying and truly objective reality, which will be referred to as the *underlying actuality*, is what produces, through relation to itself, what we experience as physical reality. And because the underlying actuality produces physical experience, or physical reality, but is not itself a physical experience or reality, the underlying actuality cannot itself be known as a physical experiential object. And yet the existence of this underlying and more fundamental level of reality can nonetheless be recognized and acknowledged, because as this work will show, in the context of accepting and recognizing the existence of this more fundamental level of reality, it becomes possible to explain, in a completely logical and consistent way, the full range of what we experience as physical reality, which includes both determinate classical physical experience, as well as indeterminate quantum physical experience.

Impactive relations

As already stated, the way in which the underlying actuality produces what we experience and observe as physical reality is by being in relation to itself. Put another way, the way in which an underlying actuality produces what we experience and observe as physical reality is by becoming involved in a specific type of relation with another underlying actuality, one of which functions as the *observer actuality* and the other of which functions as the *observed actuality*. Specifically, when two underlying actualities become involved in what will be defined as an *impactive relation*, what is produced where they meet is a sort of etching that is apprehended or known, from the perspective of the observer actuality, as a physical reality. An impactive relation is defined as a relation between two underlying actualities in which the configuration of one of those actualities is altered as a result of that relation. Such an alteration of configuration of one actuality by the other causes those actualities to become defined in relation to each other. As a result, a boundary or line is created where those actualities impactively meet and become defined in relation to each other, analogous to the boundary or line that is created where the tips of two fingers meet and become defined in relation to each other. And as will be described, it is that created boundary, which will be referred to as the *experiential boundary*, as it is apprehended or perceived from the observer actualities' side of the relation that creates it, that is what we observe and known as physical experiential reality, of both the classical and quantum varieties.

The general way in which two underlying actualities, one functioning as the observer actuality and the other as the observed actuality, form an impactive relation to create what the observer actuality apprehends as a physical experience-object-observation-reality is shown in figure 1.

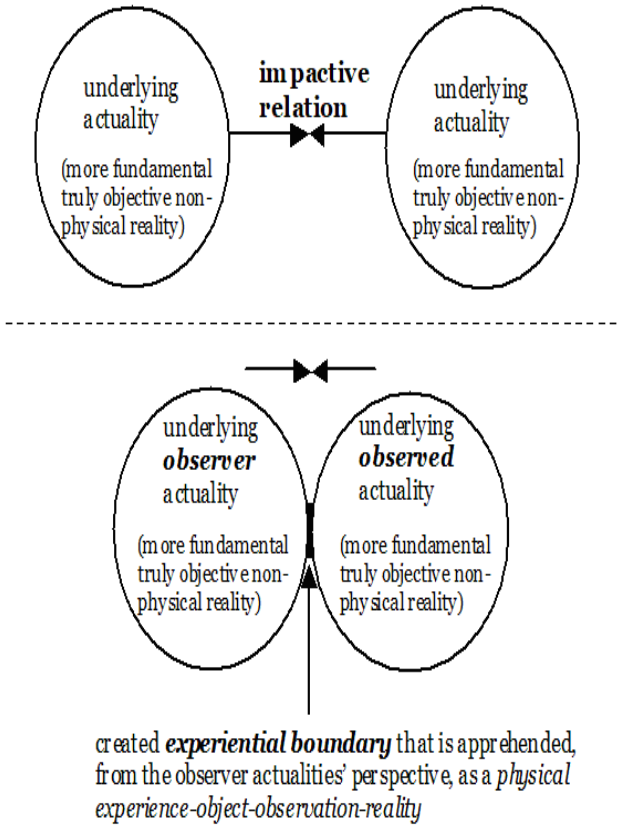

Figure 1 The basic relation or mechanism that creates what we experience as physical reality

An impactive relation between two underlying actualities is to be distinguished from an interactive relation between underlying actualities. In an interactive relation, there is a relation between two underlying actualities, but that relation does not alter the configuration of either actuality, but only alters their movement through space as a result of that interactive relation. Interactive relations between underlying actualities can be of momentary or long duration, whereas impactive relations are always momentary in nature. That is, impactive relations happen or occur in an instant, and in the moment, they happen or occur they produce an experiential boundary that is known, in that moment, from the observer actualities' perspective within that particular impactive relation, as a particular physical experience-object-observation-reality.

Physical reality as non-objective etching

Demonstrating that what we experience as physical reality is created as the product of a relation is not at all difficult. Rather, the difficulty lies primarily in overcoming our preconceptions and beliefs regarding the objective nature of physical reality. It is common knowledge that if we are to be aware of any physical reality that we have to form a relation with some external reality. For example, photons impact the retina, a neurological impulse is sent to the brain, and somehow a visual physical experience is created or produced. Clearly the production of any physical sensory experience requires the existence of a relation that involves our physical sensors being in some way impacted by an external actuality. And the same is true for any scientifically produced physical observation. That is, in the absence of some relation occurring between the measuring devices, which are functioning as the observer actuality, and the underlying actuality that is functioning as the observed actuality, there is no physical observation.

That what we believe and so assume to be intrinsic physical characteristics are actually things that must be created can be easily demonstrated with a bowl of water that is near body temperature. If the relation between skin temperature and water temperature is consistent, a bowl of water will be felt to be consistently either hot or cold, depending upon whether the skin temperature is less than or greater than the water temperature, respectively. However, if only the water temperature is held constant, around skin temperature, but the skin temperature is varied, so that in one instance it is below the water temperature, and in another above the water temperature, then the same bowl of water is able to produce, in different moments, opposite physical experiences. Specifically, if the skin temperature is less than the water temperature, then the water will be experienced as being physically hot or warm, whereas if the skin temperature is greater than the water temperature, then the water will be experienced as being physically cool or cold. In this case, the exact same bowl of water held at the exact same temperature produces opposite physical experiences, because the relation of the observer actuality to the water actuality has changed. And when that relation changes, the created experience changes, because what we experience as physical reality is not what is actually there but is the product of a specific type of relation occurring between what is actually there as the observer and observed actualities.

This example demonstrates quite clearly and unequivocally that the experienced physical reality-characteristic, which in this case is the physical characteristic of either hotness or coldness, cannot be intrinsic to what is actually there, and so must instead be the product of a relation. If what we experience as physical reality was truly objective, then absent any change in the temperature of the bowl of water, there should be no change in the physical experience, regardless of any change in the state of the observer. That is, if what we experienced as the water's hotness or coldness was purely a function of the state of the water, then how could the physical experience of the water as hot or cold change absent any change in the state of the temperature of the water? It could not. However, because what we experience as physical reality is actually the product of a relation between an observer and observed actuality, and not solely a function of what is actually there as the observed actuality, any change in the state of either actuality involved in the relation that creates the physical experience changes the product of that relation, and so changes what the observer actuality observes, knows, or experiences as the physical reality or characteristic that is produced by that relation.

All that having been said, if what we experience as physical reality is our one-sided apprehension of what is actually a two-dimensional boundary that arises where

underlying actualities impact each other, then why does physical reality appear to be three-dimensional? Physical reality appears three-dimensional because the more fundamental level of reality that, through relation to itself, produces physical reality is truly and actually three-dimensional. And because physical reality is a sort of etching of that more fundamental level of reality, physical reality is able to reproduce and so represent that true three-dimensionality. However, the three-dimensionality of physical reality is not an actual or true three-dimensionality; rather, it is only a manufactured three-dimensionality. Specifically, the three-dimensionality of any physical experience is a three-dimensionality that has to be manufactured by means of the stereoscopic overlap of two two-dimensional physical experiential images that are being produced in each side of the brain. And this manufactured three-dimensionality applies to experiences produced by all five physical senses. If the brain did not function this way to produce physical three-dimensionality, virtual reality headsets would not work. Thus, physical reality may appear to be three-dimensional, owing to stereoscopic overlap, but physical reality itself is actually only ever two-dimensional, because the created experiential boundary is only two-dimensional. And as will now be described in more detail, it is that experiential boundary, as it is created and so appears from our side of an impactive relation in which we are involved as an observer actuality that is most directly what we know as physical experiential reality.

The creation of wave and particle physical realities

Impactive relations, which are relations in which two underlying actualities become defined in relation to each other, have only two possible fundamental outcomes, from the perspective of the observer actuality. One possible outcome is that the observer actuality can primarily have its configuration altered by the observed actuality, such that it is *penetrated* by the observed actuality. The other possible outcome is that the observer actuality can primarily alter the configuration of the observed actuality by *penetrating* the observed actuality. These two fundamental impactive relational possibilities that exist with regard to how two underlying actualities can become defined in relation to each other, i.e., penetrated or penetrating, from the observer's perspective, is why physical experiential reality appears most fundamentally in terms of either a particle or a wave reality. Specifically, in an impactive relation where the observer actuality is primarily *penetrated* by the observed actuality, the experiential boundary that is created where they meet appears, from the perspective of the observer actuality, as a physical particle experience or reality. Conversely, in an impactive relation where the observer actuality primarily *penetrates* the observed actuality, the experiential boundary that is created where they meet appears, from the perspective of the observer actuality, as a physical wave experience or reality. These opposite, complementary, and mutually exclusive relations are shown in figure 2.

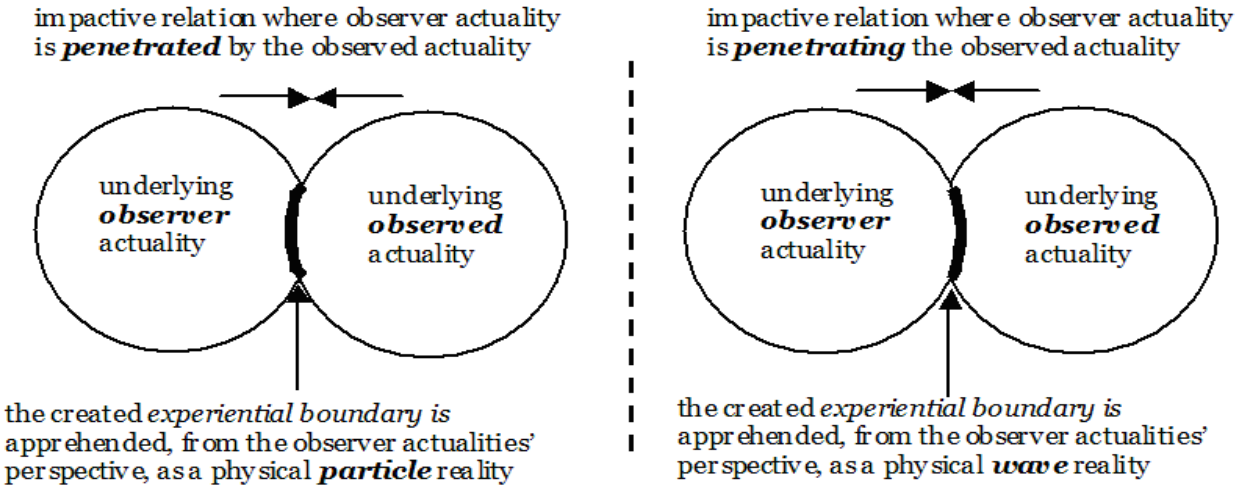

Figure 2 The opposite, complementary, and mutually exclusive impactive relations that produce the fundamental particle and wave appearances of physical experiential reality

What has just been presented as the simple experiential mechanism that causes physical reality to appear most fundamentally in the form of either a wave or particle is the same basic mechanism that produces all physical experience. And this basic mechanism, which can be referred to as the experiential process, also explains why all physical experience comes in pairs of opposites or complements. Specifically, all physical experience comes in pairs of opposites or complements because all physical experiences are created as the product of an impactive relation occurring between two underlying actualities. And for every impactive relation that is possible between two underlying actualities, there is an opposite relation between those same two underlying actualities that must also be potentially possible. And while one of those possible impactive relations creates an experiential boundary that appears, from the observer's perspective, as one particular physical experiential reality, the opposite relation always creates an experiential boundary that appears, from the observer's perspective, as the opposite or complementary physical experiential reality. Neils Bohr chose a Latin phrase that translates to "*opposites are complimentary*" as the motto to be placed on his coat of arms. And based upon what has just been described as the experiential process that underlies not just wave-particle duality, but all physical experiential duality, that motto can be expanded to state the first law of physical experiential creation, which is that *physical opposites are always the complementary products of opposite impactive relations*.

Discussion

Quantum uncertainty and the unavoidable experiential limitation

By recognizing that physical reality has to be created as the product of an impactive relation in order to be known, and that physical opposites are always the complementary products of opposite impactive relations, it becomes possible to recognize the presence of an unavoidable and inviolable limitation that must exist with regard to the simultaneous creation of opposite and so complementary physical experiences. This unavoidable experiential limitation exists, with regard to the simultaneous creation of opposite and so complementary physical experiences, simply because opposite impactive relations, with respect to any two underlying actualities, are mutually exclusive. That is, when two actualities are involved in an impactive relation with each other, those two actualities cannot, by definition, simultaneously be involved in the opposite impactive relation with each other. What this means is that when two actualities are involved in a particular impactive relation that is producing, from the observer's perspective, a particular physical experience, it is simply not possible for those same two actualities, in that same moment, to become involved in the opposite and so mutually exclusive impactive relation. And because those two actualities cannot possibly, in that same moment, become involved in the opposite impactive relation, they cannot possibly produce, in that same moment, what the observer would know as the opposite physical experience, were that opposite relation possible.

Observed actualities that are able to demonstrate the property of wave-particle duality, e.g., photons or electrons, are only observed to fully behave, in any one experimental setup, and so in any one moment, as either a wave or a particle, and not both at once. If the observed actuality is observed to fully behave as a wave, it is not observed to behave at all as a particle, and vice versa. For example, the moment an observed actuality is known as a particle, which occurs by determining which slit photons are passing through in a double slit experiment, those observed actualities cease to produce an interference pattern, and so cease to behave as waves (Davisson, 1928). And the sole reason for this is the unavoidable experiential limitation, which simply makes it impossible for a single observer or observer system to simultaneously create opposite physical experiences through impactive relation to an observed actuality, or a specific set of observed actualities, owing to the impossibility of the observer or observer system being simultaneously involved in the opposite and so mutually exclusive impactive relation with that observed actuality, or that specific set of observed actualities.

Here it must be noted that the experiential limitation does not preclude the possibility of creating partial knowledge of opposite physical characteristics. Rather, the experiential limitation only precludes the possibility of creating full knowledge of opposite physical characteristics. The ability to create partial knowledge of opposite physical characteristics is also a function of the fact that physical experiences have to be created as the product of an impactive relation in order to be known. For example, one can form an

impactive relation with an observed actuality that creates a pure position experience, in which case one is then not able to create any momentum experience; or one can form an impactive relation with an observed actuality that creates a pure momentum experience, in which case one is then not able to create any position experience; or one can form an impactive relation with an observed actuality anywhere in between those two relational extremes, and in so doing create partial knowledge of both position and momentum. In creating partial knowledge of opposite physical characteristics, the extent to which either characteristic is known is the extent to which the opposite characteristic must remain unknown. And this is simply because the experiential limitation dictates that the impactive relation that is creating that partial physical knowledge makes it impossible for the same observer and observed actualities to be simultaneously involved in the opposite impactive relation needed to create what the observer would know as the opposite partial physical knowledge, were the opposite impactive relation possible.

By this point it may be obvious that it is this unavoidable and inviolable experiential limitation, which precludes observer and observed actualities from being simultaneously involved in mutually exclusive impactive relations, that is responsible for producing the phenomenon of quantum uncertainty—also known as Heisenberg's uncertainty principle, or simply the uncertainty principle—which asserts a fundamental limit with regard to the precision with which certain pairs of physical properties of a particle, known as complementary variables, such as position and momentum, can be known. What Heisenberg himself put forth as the mechanism underlying his uncertainty principle, and what is still taught in introductory physics classes as the mechanism underlying quantum uncertainty, is that uncertainty is introduced as a result of a mechanical measurement disturbance. However, relatively recent experiments have shown that the act of measuring can introduce less uncertainty than is required by the uncertainty principle, thereby dispelling the notion that quantum uncertainty is produced by such a mechanical measurement disturbance (Erhart *et al.,* 2012; Rozema *et al.,* 2012). Indeed, once the basic mechanism by which physical experience is created is known, we need look no farther than the unavoidable experiential limitation that exists with regard to simultaneously creating opposite physical experiences to discover the actual mechanism that produces quantum uncertainty.

In essence, quantum uncertainty exists because the experiential limitation dictates that for every physical "something, " or combination of "somethings," that a single observer or observer system knows, through impactive relation to an observed actuality, there is an opposite physical "something," or combination of "somethings," which that same observer or observer system cannot possibly know in that same moment, with regard to that same observed actuality. And this is because every physical "something," or combination of "somethings," that a single observer or observer system knows, with regard to an observed actuality, must be produced through, and so derived from, an impactive relation with that observed actuality. And in the moment that impactive relation exists and produces the physical observation, i.e., produces the known physical "something," or combination of "somethings," it becomes completely impossible for the same observer or observer system, in that same moment, to become involved in the opposite and so mutually exclusive impactive relation with that observed actuality. And because it is not possible for the same observer to become involved in that opposite impactive relation, it is simply not possible for the same observer to produce whatever physical experience-observation is the opposite of the physical experience-observation that is already being produced through impactive relation with that observed actuality.

To summarize, quantum uncertainty exists because when an observer becomes involved in an impactive relation with an observed actuality, and so creates a physical experience-observation, this immediately takes off the table the possibility of that observer being, in that same moment, in the opposite and so mutually exclusive impactive relation with that same observed actuality. And because a physical experience can only exist if there is an impactive relation occurring between two actualities that produces an experiential boundary that is then known from the observer's perspective within that relation as a particular experience, when an impactive relation between two actualities is just not possible, owing to the experiential limitation, then the particular physical experience which that particular relation would produce cannot possibly be produced, and so that particular physical experience cannot

possibly be known or observed. Thus, the basis of quantum uncertainty is not a mechanical measurement disturbance. Rather, the basis of quantum uncertainty is nothing more than the unavoidable mechanical limitation that makes it impossible for observer and observed actualities to be simultaneously involved in mutually exclusive relations, combined with the fact that physical opposites are created as the complementary products of opposite and so mutually exclusive impactive relations. It is just that simple.

The difference between classical and quantum physical reality

The experiential limitation is the second law of physical experiential creation, and it is a law that is as valid and unbending as any known physical law. But the experiential limitation is not a law that dictates how physical reality behaves. Rather, the experiential limitation is a law of physical experiential creation that dictates how physical reality both can and must appear, depending upon the relational circumstances under which a particular physical experiential reality is being created. And now that it is known that this law of physical experiential creation exists, and why it exists, it now becomes possible to understand the actual difference between physical reality as it is observed to exist classically, as a determinate physical experiential reality, and physical reality as it is observed to exist at the quantum level, as an indeterminate physical experiential reality. Because as will be described, the actual difference between physical reality as it is observed to exist classically, or as a determinate reality, and physical reality as it is observed to exist at the quantum level, or as an indeterminate reality, has nothing whatsoever to do with any actual difference in the more fundamental and truly objective reality that actually exists where both quantum and classical physical realities appear to be. Rather, what will be shown is that the only difference between physical reality as it is observed to exist as a determinate classical reality, and physical reality as it is observed to exist as an indeterminate quantum reality, has to do with a very specific difference in the relational conditions under which each of these two differently appearing types of physical reality is created.

Consistent relations between observer and observed actualities produce experiential boundaries that have a consistent orientation, and so a consistent appearance, from the observer's perspective, and so appear to the observer as consistently appearing physical experiences. This consistency of relation between observer and observed actualities is why sensory interactions or relations tend to produce consistent physical experiences. For example, this consistency of relation is why rocks always feel hard and pillows always feel soft. And this consistency of physical sensory experience helps to reinforce the illusion of physical objectivity, i.e., the illusion that physical experiences exist as they are observed to exist independent of their observation. For example, this consistency of relation produces the illusion that the observed actually that exists where a rock appears to be is intrinsically hard, or intrinsically possesses the physical characteristic of hardness, when in actuality that physical characteristic, just like the characteristics of hotness and coldness, does not exist unless and until it is created as the experiential product of an impactive relation occurring between a sensory observer and an observed actuality. And the same illusion of objectivity is true for any physical characteristic, regardless of how it is created, i.e., whether through sensory relation or experimental relation.

As already described, the sensory experiential consistency that reinforces the illusion of physical objectivity is easily dispelled by simply varying the relation of an observer to a bowl of water, with the water held at a constant temperature that is near body temperature. However, this sort of variation of the observer actuality with respect to the observed actuality does not usually occur in the normal course of creating sensory physical experiences. And this is because, in the normal course of the creation of sensory physical experiences, the observer actualities that are the physical sensors normally do not change their orientation relative to the observed actualities with which they impactively interact to produce those sensory physical experiences. But when that relation changes, as a result of some change in either the observer or observed actuality, then the created physical experience must change as well, because the physical experience is never the observed actuality. Rather, the physical experience is only ever the product of an impactive relation that is taking place between the truly objective realities that are there, functioning as the observer and observed actualities.

Like sensorially produced physical experiences, experimentally produced classical physical experiences also have a consistency of appearance. And like sensorially produced physical experiences, this consistency of appearance in experimentally produced physical experiences is a function of an underlying consistency of impactive relation that is present in the production of these experimentally produced physical experiences. However, the consistency of experimentally produced classical physical experiences has as its basis a different mechanism than that which produces the consistency of physical sensory experience. As just stated, sensorially created physical experiences appear consistent, under normal circumstances, because the observer and observed actualities are consistent, and so their impactive relations are also consistent, and so produce experiential boundaries that have a consistent appearance from the observer's side of those relations. However, in experimentally created physical experiences the observer is freed from this consistency of relation, because in experimental observations the observer actuality does not have to be held constant, but can vary, depending upon the experimental setup and the experimental sensors that are being used, as part of an observer actuality system, to impactively interact with a given observed actuality. And yet, even though this additional degree of freedom exists in the creation of experimentally produced physical experiences, experimentally produced classical physical experiences still have a consistent and so determinate appearance. What this indicates is that experimentally produced classical physical experiences are still being created through what must be a consistent set of impactive relations. And what causes this consistency of relation, even in the face of the additional freedom of relation afforded by the use of experimental sensors, as opposed to our biological sensors, is the unavoidable functioning of the experiential limitation.

In order to understand how the experiential limitation functions in the creation of classical physical experience to produce a determinate physical reality, it is necessary to introduce the concept of *experiential entanglement*. Experiential entanglement just means that the observer actuality is already involved, either directly or indirectly, in an impactive relation with the observed actuality, prior to becoming involved in another impactive relation with that observed actuality. Direct involvement would be like already sitting on a chair that one then impactively interacts with, whereas indirect involvement would be like sitting on someone's lap who is sitting on a chair that one then impactively interacts with. In most cases, experiential entanglement is likely the result of an already existent sensory relation with the observed actuality. In any case, where there is experiential entanglement between the observer and observed actualities, i.e., an already existent direct or indirect impactive relation, the experiential limitation is already functioning to limit the ways in which the observer is able to be in any subsequent impactive relation with the observed actuality, and so is already functioning to limit the physical experiences that it is possible to create and know through impactive relation with that observed actuality. Put another way, because the experiential limitation is already functioning to limit the possible relations between the observer and observed actualities, owing to the presence of an already existent direct or indirect impactive relation that exists between the observer and observed actualities, the set of impactive relations that the observer can form with the observed actuality is limited to those that are not mutually exclusive of the direct or indirect impactive relation in which it is already involved with that observed actuality.

And so, there is an added degree of freedom involved in the creation of experimentally produced physical experiences, owing to the ability to use different sensors, and so differently configured observed actualities, to impactively interact with the observed actuality. However, when there nonetheless exists experiential entanglement between the observer and observed actualities, for whatever reason, that added degree of freedom is nullified by the functioning of the experiential limitation, which functions to limit the possible relations of the observer to the observed actuality to those that are not mutually exclusive of the observer's already existent direct or indirect impactive relation with that observed actuality. And as a result, the physical experiences that it is possible to produce, apprehend, and so observe as a result of forming an impactive relation with an observed actuality with which one is experientially entangled are reduced by a specific fifty-percent. And again, this is because the only impactive relations possible between those two actualities, owing to their experiential entanglement, are

those relations that are not mutually exclusive of the already present direct or indirect impactive relation that exists between those two actualities.

On the other hand, the reason experimentally produced quantum physical experiences are able to be created in an inconsistent or variable way, e.g., appearing either as a wave or as a particle, is because the extra degree of freedom afforded by being able to use variable experimental sensors or setups as the observer actuality is not being nullified by the functioning of the experiential limitation, prior to a physical observation or measurement being made through impactive relation to an observed actuality. And the reason that extra degree of freedom is not being nullified by the functioning of the experiential limitation is because at the micro or quantum level it is possible for an observer to form impactive relations with observed actualities in the *absence* of experiential entanglement between those actualities, i.e., in the absence of an already existent direct or indirect impactive relation between those observed actualities. And so, in the absence of any prior limitation being imposed upon the impactive relations it is possible for an observer actuality to become involved in with an observed actuality—owing to the absence of experiential entanglement—it remains possible for the observer to become involved with the observed actuality in either the penetrating impactive relation that creates a physical wave experience-reality, *or* the penetrated impactive relation that creates a physical particle experience-reality.

To summarize, classical physical experiences represent the specific class of physical experiences that are created when an observer and an observed actuality become involved in an impactive relation, and so produce a physical experience, in the *presence* of experiential entanglement between those two actualities, i.e., in the presence of an already existent direct or indirect impactive relation between those actualities. The presence of experiential entanglement makes the created physical observation predictable, because it limits the observer and observed actualities to forming a specific set of impactive relations, and so limits the physical experiences they can create, through impactive relation, to a specific set of physical experiences. Conversely, quantum physical experiences represent the specific class of physical experiences that are created when an observer and an observed actuality become involved in an impactive relation, and so produce a physical experience, in the *absence* of experiential entanglement between those two actualities, i.e., in the absence of an already existent direct or indirect impactive relation between those actualities. The absence of experiential entanglement makes the created physical observation unpredictable, because in its absence the observer and observed actualities are not limited to forming a specific set of impactive relations, in which case they are then not limited to creating, through impactive relation, a specific set of physical experiences.

The creation and collapse of the wave function

Owing to the absence of experiential entanglement, the experiential limitation does not function, prior to the creation of an indeterminate quantum physical experience, to limit which physical experiences can potentially be created through impactive relation between an observer and observed actuality. And owing to this lack of a prior limit upon which impactive relations are possible, an observed actuality with which an observer has no experiential entanglement can only be described and so be expressed, *in physical terms*, in terms of all the physical experiences that it is potentially possible to create through impactive relation with that observed actuality. And that description, which expresses the observed actuality—which is not a physical reality—in terms of all the physical experiences that it is potentially possible to create through impactive relation with that observed actuality, is the *wave function*.

In essence, the wave function is created as science does its best to express, in physical terms, the state of a non-physical reality or actuality, in the absence of any direct or indirect impactive relation with that actuality. In the absence of any direct or indirect impactive relation between an observer and an observed actuality, and so in the absence of experiential entanglement, there is simply nothing physically definite that can be said about an observed actuality, because anything physically definite that can be said about an observed actuality first has to be created through impactive relation with that actuality. And so, when an observer has no experiential entanglement with an observed actuality, there is absolutely nothing physically definite that observer can say with reference to that actuality. And when there is nothing physically definite that can be said about an observed actuality, owing to

an absence of experiential entanglement, the only things that can possibly be said physically about such an actuality have to be physically indefinite statements, and so have to be probabilistic statements. And again, those physically indefinite statements regarding an observed actuality with which an observer has no experiential entanglement, taken as a whole, are expressed as the wave function. Put another way, the wave function has to express the underlying actuality in terms of physical probabilities, because the wave function is an expression born of the complete and utter absence of having anything physically definite to express with regard to an observed actuality, owing to an absence of experiential entanglement between observer and observed actualities.

However, the wave function, as a probabilistic expression, cannot be an accurate description of the observed actuality, if the observed actuality is a truly objective reality, which it is. Physical experience is like a reflection, and like a reflection it has a certain appearance. And also like a reflection, that appearance becomes superimposed upon whatever it is that is functioning as the reflective surface. And in this way, whatever that physical appearance is—i.e., wave or particle, probable or definable, random or predictable—becomes superimposed upon the underlying actuality that is producing the physical experience. This then causes the underlying actuality to then appear as one or the other of these physical experiential opposites, even though the underlying actuality is none of these physical experiential things, i.e., it is neither a wave nor a particle, is neither probable nor definable, and is neither random nor predictable. These are all physical experiential characteristics that have to be created, and which, once created, become superimposed upon the underlying actuality, thereby creating the appearance that what is actually there is somehow either this or that. The underlying actuality exists in a definite state, but it does not exist in a state that can be defined through this or that physical appearance, because physical appearances have nothing to do with what is actually there, because physical appearances have only to do with the way in which what is actually there is being in relation to itself as it produces a physical experience. Put another way, physical appearances provide no real information with regard to the underlying actuality. Physical appearances only provide information regarding the specific type of impactive relation, i.e., either penetrated or penetrating, that the underlying actuality became involved in, in order to create a particular physical experience. As Heisenberg himself once said, "We have to remember that what we observe is not nature herself, but nature exposed to our method of questioning" (Heisenberg, 1962).

As an analogy, if you stick your finger in water to feel its temperature, you produce a wave. That wave is not a feature of the water; rather, the wave is an artifact produced as a result of the relation with the water in which you became involved in order to create the experience of its temperature as either hot or cold. As an observer actuality, whenever we create any physical experience we are unavoidably producing these types of artifacts, as we either penetrate, or are penetrated by, the observed actuality. When we, as the observer, are penetrated by an observed actuality, which occurs in the creation of both sensory and classical physical experiences, the artifact that is produced, as a function of the way in which the experiential boundary appears in such a relation, is the appearance of physical reality as particulate and definable. Conversely, when we, as the observer, are penetrating an observed actuality, which occurs in the creation of quantum physical experiences, the artifact that is produced, as a function of the way in which the experiential boundary appears in such a relation, is the appearance of physical reality as a probability wave and so as random. These two physical experiential artifacts, which are actually produced by opposite impactive relations, are what serve to create the appearance, and so serve to create the illusion, that reality is somehow definable and non-random at the macro level, but is completely undefinable and random at the quantum level.

The model of physical experiential creation that is being presented here, which describes the wave function as an expression that superimposes the appearance of probability upon what is actually a definite non-physical reality—as opposed to how the wave-function is usually imagined, which is as an expression that reveals reality to actually exist in a state of probability—vindicates Einstein for his never-relinquished view that the probability and randomness that is so much a part of quantum theory is not actually a feature of reality. It is this view that led to Einstein's oft quoted and oft paraphrased statement that god does not play dice (Born, 1971). And we can now take that statement

farther, by saying that even though god may not actually play dice, god must appear to play dice, as long as one fails to understand how the game of physical experiential creation is being played. Because until that game is understood, reality must continue to appear to actually possess qualities that are only being superimposed upon it as a function of the relational process by which physical reality is itself being created. Specifically, macroscopic physical reality appears particulate and definable as a function of the way the created experiential boundary appears from the observer's perspective in an impactive relation where the observer is penetrated by the observed actuality. Conversely, quantum physical reality appears wavelike and random as a function of the way the created experiential boundary appears from the observer's perspective in an impactive relation where the observer penetrates the observed actuality.

Thus, the probabilistic wave function is simply what can be said about an observed actuality when there is nothing physically definite to say about that actuality, owing to the absence of experiential entanglement with that actuality. However, as soon as one does form an impactive relation with that actuality, and in so doing produces an indeterminate quantum physical experience-observation, there is now experiential entanglement with that actuality, in which case that actuality can no longer be expressed by the wave function, i.e., its wave function collapses. And the reason its wave function collapses is because, once there is experiential entanglement with an observed actuality the experiential limitation then functions to limit any further impactive relations that the observer can subsequently become involved in with that observed actuality to those that are not mutually exclusive of the impactive relation in which the observer is already involved with that actuality. This limitation of possible impactive relations then functions to limit the physical experiences that it is possible to create through subsequent impactive relation to that actuality. And once those experiential possibilities are limited, that observed actuality can no longer be expressed by the wave function, because the wave function only represents observed actualities that still have all their impactive relational and so physical experiential possibilities open.

This explanation demonstrates that the collapse of the wave function—where an observed actuality that can only be expressed in terms of the probabilistic wave function, once an observation is made using that actuality, can thereafter only be observed and expressed as a classical or deterministic physical reality—has nothing whatsoever to do with any imagined transmogrification of a probabilistic reality into a deterministic reality. Rather, the collapse of the wave function has only to do with a change in the relational conditions under which a particular actuality can be used to create a physical experience or observation. Specifically, the collapse of the wave function occurs when an observed actuality goes from being an actuality with which an observer has no experiential entanglement, to an actuality with which that observer is experientially entangled. That is all.

Absent experiential entanglement with an observed actuality, there is nothing physically definite that can be said with regard to that actuality, and so that actuality has to be expressed by the wave function. But once an observation is made through impactive relation to that actuality—which impactive relation produces an indeterminate quantum physical reality—there is now experiential entanglement with that actuality, owing to the direct impactive relation that produced the indeterminate quantum observation. And once there is experiential entanglement that actuality can no longer be expressed by the wave function, because that actuality now must function in any subsequent impactive relations to produce a determinate or classical physical reality, owing to the experiential limitation, which is brought into play the moment experiential entanglement exists. And so, to restate in slightly different terms, the collapse of the wave-function occurs when an observed actuality transitions from being an actuality with which an observer has no direct or indirect impactive relation, to being an actuality with which an observer has a direct or indirect impactive relation. That is all.

To summarize, classical physical realties are those that are created in the presence of experiential entanglement, whereas quantum physical realities are those that are created in the absence of experiential entanglement. And experiential entanglement is just a term that indicates the presence of either a direct or indirect impactive relation between actualities. Where there is no experiential entanglement between observer and observed actualities, the observed actuality can only be expressed by the probabilistic wave function, prior to that actuality

taking part in an impactive experiential relation that produces an observation. But once any measurement or observation is made using that observed actuality, that actuality is now experientially entangled with the observer, in which case any further measurements or observations that are made or created using that actuality must now appear as a determinate classical physical measurement or observation. This explanation demonstrates clearly that the collapse of the wave function involves no actual change whatsoever in the observed actuality. Rather, the collapse of the wave function involves nothing more than a *collapse of the impactive relational possibilities* that exist between an observer and an observed actuality, as those relational possibilities go from including all possible impactive relations when there is no experiential entanglement between those actualities, to including only a specific fifty percent of possible impactive relations, once experiential entanglement exists between those actualities.

The experiential basis of quantum nonlocality

The phenomenon of quantum nonlocality is also explainable in the context of the model of physical experiential creation being presented here, absent any need for Einstein's spooky action at a distance. Demonstrating nonlocality requires two entangled particles, which are always observed to be in opposite spin states, and involves the wavefunction of a second entangled particle immediately collapsing as the result of an observation made or created through impactive relation to a first entangled particle, regardless of how far apart those two particles are separated. Very simply, particles that demonstrate the property of quantum entanglement represent an entangled pair of observed actualities, and quantum entanglement itself represents a relation between two actualities that is more fundamental than the impactive relations that produce experiential entanglement between actualities.

That having been said, the phenomenon of nonlocality occurs as the wave function of a second entangled particle (second observed actuality) immediately collapses once a measurement is made upon a first entangled particle (first observed actuality). And the reason the wave function of the second entangled particle collapses, once a measurement is made upon a first entangled particle, is because once a measurement is made upon the first entangled particle, the observer system is then involved in an indirect impactive relation with the second particle, through the quantum entanglement of the two particles. That is, because the two particles are in some way fundamentally related through quantum entanglement, a direct impactive relation with either particle is equivalent to an indirect impactive relation with the other particle. And once the observer system is involved in an indirect impactive relation with the second particle, it is then experientially entangled with the second particle. And once the observer system is experientially entangled with the second particle, the experiential limitation is brought into play and the wave function of the second particle collapses, i.e., the impactive relational possibilities that existed between the observer and the second particle go from all possible relations, to a specific fifty percent of possible relations.

Owing to the superimposed illusion of probability, there has been the assumption that the collapse of the wave function of the second particle somehow involves whatever is there actually transitioning from being a probabilistic reality to being a determinate reality. But there is no such transition, because what is actually there is neither probabilistic nor determinate. The only transition is a change in the relational possibilities that exist between the observer and the observed actuality. That is, when an observer makes and so creates an observation through impactive relation to the first entangled particle, all that changes are the relational conditions under which the observer can be in impactive relation to the second entangled particle or observed actuality. And as those relational conditions change, the physical experiences that can be created as a result of those relations must also change. When all relational possibilities with regard to the second entangled particle remain open, the second particle can only be expressed by the probabilistic wave function. However, once a specific fifty percent of those relational possibilities collapse, owing to the presence of the experiential entanglement that is introduced when the observer becomes involved in an impactive relation with the first entangled particle, the second particle can only be known or observed as a determinate classical physical reality.

Each single definite state of an observed actuality has opposite physical experiential possibilities it can manifest, e.g., wave or particle,

position or momentum, positive or negative spin. Which physical experiential possibility, or combination of possibilities, is brought out or made physically manifest depends upon the specific impactive relation with the observer in which the observed actuality becomes involved. On the other hand, the other experiential possibility, or combination of possibilities, becomes simultaneously impossible, as a function of the experiential limitation, the moment its opposite is made physically manifest. For example, the definite state of either entangled particle, prior to any observation made through impactive relation to either particle, could potentially produce the observation of either positive or negative spin. However, once the observer establishes an impactive relation with the first entangled particle and in so doing produces an observation of the first particle's spin state, the observer is no longer free to be in either impactive relation with the second particle. Rather, the observer can only be in an impactive relation with the second particle that is not mutually exclusive of the already established relation with the first particle, owing to the quantum entanglement that exists between the particles. And so, the established relation with the first particle limits any subsequent relation with the second particle. Specifically, impactive relation with the first particle produces an observation of a particular spin state, either positive or negative. And that established relation, through experiential entanglement, then limits any subsequent relation of the observer to the second particle to the specific impactive relation that causes the second particle to physically manifest, i.e., produce an observation of, the opposite spin state.

This explanation of the experiential mechanism underlying the heretofore inexplicable phenomenon of quantum nonlocality is completely consistent with the way in which all of the other heretofore inexplicable quantum phenomena in this work have been described, which is as a function of the related facts that physical experience has to be created as the product of a relation in order to be known, and that this necessity of creation through relation imposes a limitation with regard to the experiences it is possible for a single observer or observer system to create as a function of any experiential relations in which the observer or observer system is already involved, either directly or indirectly.

Further, this explanation of nonlocality demonstrates that the underlying realities or observed actualities do not need to change as a result of their involvement in an experiential relation in order to produce the phenomenon of nonlocality. Rather, all that actually needs to change, and all that actually does change, are the relational conditions that exist between the observer and the second entangled particle. And those relational conditions change as a result of the observer's impactive relation with the first entangled particle, which then produces, through the quantum entanglement of the two particles, an indirect impactive relation with the second particle, thereby bringing the experiential limitation into play with respect to any subsequent impactive relation between the observer and the second entangled particle. And so, prior to any observation being made through impactive relation to either entangled particle, both particles or actualities are in a definite non-physical state, and after one or both observations are made, both particles or actualities remain in the same definite non-physical state. However, prior to any observation being made through impactive relation to the first entangled particle, the definite non-physical state of the second particle, owing to an absence of experiential entanglement, can only be expressed by the wave function. However, once an observation is made or created through impactive relation to the first entangled particle, that same definite non-physical state of the second particle, owing to the presence of experiential entanglement, can now only be expressed as a determinate physical reality. Thus, observation of the first particle does not change either the first or the second particle; rather, observation of the first particle only changes the impactive relational possibilities that exist between the observer and the second particle. And it is that change, and that change alone, that is all that is needed to produce the phenomenon of quantum nonlocality.

Paradox lost

Richard Feynman once said that trying to understand the behavior of quantum reality was like "going down the drain, into a blind alley from which nobody has yet escaped" (Feynman, 1965). Well, we have just gone down that drain, and instead of becoming lost and more confused about what is happening, as is usually the case, we have come out the other side in possession of a single, consistent, and clear explanation of why physical

reality appears as it does at both the quantum and classical level. And the primary reason physical reality appears as it does, at both the quantum and classical level, is because in order to be known, physical reality has to first be created as the product of a relation. That is all. There are no paradoxes; there is only either understanding or confusion about what is actually taking place in order for there to exist any determinate or indeterminate "something" that we know as a physical reality. Where there is confusion, paradox appears everywhere, and where there is understanding, paradox either does not arise, or simply evaporates. When the idea persists that physical experiential reality is what is actually there, where it only appears to be, there is confusion, and paradox arises everywhere. But when one sets aside the idea that physical experiential reality is what is actually there, in favor of the idea that physical experiential reality is like an etching, reflection, or rainbow that has to be created as the product of a relation in order to be known, understanding then becomes possible, and all the seeming paradoxes simply vanish. Because as it turns out, most if not all of the seeming paradoxes that are associated with quantum theory arise as a result of trying to deal with what is only a rainbow as if it were an objectively existent structure.

All physical reality is rainbow-like or reflection-like in nature. This does not mean that there is not something actually there where physical reality appears to be, it just means that what we experience as physical reality is not itself that actual something, in the same way a reflection that arises upon the surface of a pool of water is not the actual something that is there, where it appears to be. Absent this understanding, quantum reality is a blind alley from which there is no escape, because trying to understand quantum reality within the context of physical realism is simply not possible, because there actually is no such thing as an objectively existent physical characteristic. All physical characteristics have to be created, because all physical characteristics require the creation and one-sided apprehension of an experiential boundary. However, once the rainbow-like nature of physical reality is understood, quantum reality ceases to be a blind alley from which there is no escape, and instead becomes the pot of gold that was always waiting for both science and humanity at the end of the physical experiential rainbow, pointing clearly toward a previously unknown level of reality, and in so doing, pointing science and humanity in the direction of the next frontier in humanities' ongoing mission to explore the nature of reality.

Conclusions

Now that the relatively simple experiential mechanism that underlies the phenomena that lie at the heart of quantum physics has been revealed, it now becomes possible to learn what it is that quantum reality actually has to teach us regarding the nature of reality. And one of the things that quantum reality has to teach us regarding the nature of reality is that what we experience as any physical reality has to be created through an act of observation. This means that nothing that we experience as a physical reality can be a truly objective reality, because what we experience as any physical reality, and so as any physical characteristic, only exists as it appears to exist as a function of the relation by which it comes into existence as a physical experiential reality. Another thing that quantum reality has to teach us is that there is a more fundamental level of reality that underlies physical reality, and that that more fundamental level of reality is truly objective, which is to say, it is a non-physical reality that exists in a definite state, regardless of whether or not it is taking part in a relation that creates a physical experience-observation-measurement-reality. However, the definite state in which any more fundamental reality exists, as an observed actuality, is not a state that can be fully defined physically, because physical definitions have to be created, and there is an unavoidable limitation that makes impossible the simultaneous creation of the opposite physical characteristics that are needed for full physical definition.

These two related lessons taught by quantum reality, i.e., that physical reality is a non-objective reality that has to be created as the product of a specific relation taking place at a more fundamental and truly objective level of non-physical reality, make it clear that science is going to have to fundamentally change the way in which it approaches reality, if it is to probe deeper into reality. Because as it turns out, understanding physical reality was never the end game with regard to understanding the nature of reality. That was just the appearance. To the contrary, understanding physical reality was just the first riddle that had to be solved to get us deeper into the game. And now that that riddle has been

solved, i.e., now that physical reality is known as a reality that is being created by a more fundamental reality, science finally has the opportunity to truly dive deeper into reality, as opposed to remaining stuck on the surface of reality, where the reflection that is physical reality lies.

By failing to realize that physical reality is a created reality, science has been in a position that is analogous to that of a person who is looking at a reflection, but does not know that what they are looking at is a reflection. And when one is looking at a reflection that one does not know is a reflection, two related illusions arise. The first illusion is that the reflection appears to be what is actually there, and the second and related illusion is that what is actually there, i.e., the mirror or reflective object, becomes completely obscured, even though it must remain in plain sight, else there would be no reflection. And as long as one believes the reflection to be what is actually there, one never even looks for the mirror, and so never even looks for what is actually there. However, the moment one realizes that what one is looking at is a reflection, the mirror immediately reappears. Put another way, the moment one realizes that what one is looking at is a reflection, what is actually there, underlying the reflection, immediately comes back into view. And it is for this reason that revealing the reflection-like nature of physical reality, as this work has done, simultaneously causes the more fundamental reality that both underlies and creates physical reality to be brought into view.

This new view of reality, which must include both physical reality and the more fundamental reality that creates physical reality, means that science is going to need to come to grips with the fact that there are two types of physical experiential information; one of which does not reveal any features of the more fundamental reality, and the other of which does reveal features of the more fundamental reality. The type of physical experiential information that does not reveal any features of the more fundamental reality is the appearance of the physical reality as either a wave or a particle. The appearance of a physical reality as either a wave or a particle, or as apparently either random or objective, respectively, does not reveal any features of the underlying actuality. And this is because the appearance of a physical reality as either a wave or a particle only provides information regarding the specific type of impactive relation—i.e., penetrating or penetrated, respectively, from the observer's perspective—that created the physical reality. The information that the appearance of a physical reality as either a wave or a particle provides is no different than the information provided by knowing the color of a pencil that was used to make an etching. That is, knowing a pencil's color provides information regarding how a particular etching was created, but provides no information whatsoever with regard to the underlying reality that was etched by that pencil. In other words, whether a physical reality appears as a wave or as a particle is completely meaningless in terms of providing any useful information about the more fundamental reality that is producing the physical reality, because the appearance of a particular physical reality as either a wave or particle is purely a function of, and artifact produced by, either the penetrating or penetrated nature of the impactive relation through which that particular physical reality is being created.

On the other hand, the type of physical experiential information that does reveal features of the more fundamental reality is information pertaining to the behavior or motion of physical reality. The behavior of physical reality, i.e., its movements and interactions, are related to features of the more fundamental reality, because although physical reality may not be that more fundamental reality, it is nonetheless a sort of etching of that more fundamental reality. And as such, the observed behavior of physical experiential reality is able to provide relevant and useful information regarding that more fundamental reality. However, a single pencil stroke does not provide much information regarding the underlying reality that is being etched, and likewise, a single experience of physical behavior does not provide much information about the more fundamental reality. But taken together, or as a whole, individual strokes form a picture that reveals something of the underlying structure that is being etched. And in the same way, the behavior of physical reality, i.e., its movements and interactions, which are derived from features of the more fundamental reality, when taken as a whole, will eventually be seen to form a picture that will reveal the structure of that more fundamental reality.

Science does not need an objective physical reality in order to function; science only needs an objective reality in order to function. And so, although science needs to give up on the

idea of physical reality as an objective reality, in so doing science will gain far more than it loses. For in giving up on the idea of physical reality as an objective reality, all science will really be giving up is its adherence to an illusion that has kept it trapped within that illusion, where it has had no choice but to attempt to perform the impossible task of understanding reality only in terms of that illusion. On the other hand, what science will gain by giving up the idea of physical reality as an objective reality is access to the more fundamental and truly objective reality that has always been there, but which had to go completely unnoticed for as long as physical reality was being known as what is actually there. One cannot possibly understand something that one cannot pay any attention to, and one cannot pay any attention to something that one cannot possibly know is there. And while there is no hope of ever understanding something that one cannot possibly notice, once something has been noticed there then exists at least the possibility that it can be understood. And so, although we may not know much right now about the more fundamental reality, other than that it produces physical reality, that it exists in a definite or objective non-physical state, and that each definite state of an observed actuality has the potential to manifest as opposite physical experiential characteristics or states, we have already acquired the most important information that we can possibly have at this point regarding the more fundamental reality. And that is simply the information that it exists. Because that is all the information that science needs to be able to finally turn its attention toward that more fundamental reality. And once science turns its attention toward that more fundamental reality, no longer distracted by needing to explain reality in terms of the red herrings of the wave and particle appearances, understanding will inevitably follow.

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