"IN CHRIST ALL THINGS HOLD TOGETHER": A CHRISTIAN PERSPECTIVE (VIA LEVINAS AND SHIMONY) ON QUANTUM ENTANGLEMENT

David Grandy

Christians regard the universe as having divine import. In the gospel of John we read: "For God so loved the world, that he gave his one and only Son, that whoever believes in him shall not perish but have everlasting life" (John 3:16).[1] The word *world,* having more than one meaning, might be taken to denote human society, particularly since the passage seems to zero in on human believers. Who else, we might ask, could exercise faith unto everlasting life?

It is surprising, then, to learn that, in the biblical Greek, the word for world in this passage is *kosmos,* which, like its English derivative, generally denotes the harmonious, orderly arrangement of the universe. If the verse is read with this meaning in mind, the scope of God's loving mercy broadens to include all creation, not just humankind: God's salvific aim may be vastly larger than we often imagine it to be. This is not to diminish humankind's role in God's plan, but to enlarge it. Humans alone bear the *Imago Dei* commission, and that commission expands as it is resized to cosmic parameters.[2]

1. All biblical references are from the New International Version.

2. Speaking of the *Imago Dei* commission, William P. Brown writes: "Human beings alone, according to the [Genesis] text, bear an iconic relation to the divine" (*The Seven Pillars of Creation: The Bible, Science, and the Ecology of*

There are two interlaced threads here that need to be drawn apart and then allowed to re-entwine. The first, just introduced, addresses God's concern for the universe. Paul highlights the cosmic significance of Christ's saving work by insisting that Christ is the "image of the invisible God, the firstborn over all creation. For by him all things were created: things in heaven and on earth. . . . He is before all things, and in him all things hold together. . . . For God was pleased to have all his fullness dwell in him, and through him to reconcile to himself all things, whether things on earth or things in heaven, by making peace through his blood, shed on the cross" (Colossians 1:15–20).

The work of redemption, that is, is no less comprehensive than the work of creation. These two works are, in fact, different facets of the same foundational truth—God's all-embracing love.

Similar passages are scattered throughout the entire Bible, although in the Old Testament the emphasis tends to fall on nature's propensity to rejoice in the goodness and glory of creation. This is the second thread: the cosmos is alive, in some way, to the drama of creation and salvation being played out on its stage. Humans are not the sole beneficiaries of God's mercy, nor are they alone in being able to experience that mercy and to express thanksgiving. The Psalmist exhorts us to praise the Lord, but then adds that our praise will be blended with that of the angels and, further, with the adulation of many things that we would probably regard as unmindful of God and even lifeless:

> Praise him, sun and moon, praise him, all you shining stars.
> Praise him, you highest heavens and you waters above the heavens. . . .
> Praise the Lord from the earth, you great sea creatures and all ocean depths,
> lightning and hail, snow and clouds, stormy winds that do his bidding,
> you mountains, and all hills, fruit trees and all cedars,

Wonder [Oxford: Oxford University Press, 2010], 42). He also insists that "The world that God so loved in John 3:16 is nothing less than cosmic" (9).

> wild animals and all cattle, small creatures and flying birds. (Psalms 148:3–10)

Commenting on this passage, Jeanne Kay states: "In the Psalms, hills are girdled with joy, valleys shout for joy (65:13–14), floods clap their hands, the whole earth worships God and sings praises to His name (66:1–4; 89:6)."[3]

While alien to modern thought, this orientation comports with the biblical sensibility that "the creation waits in eager expectation for the sons of God to be revealed . . . in hope that the creation itself will be liberated from its bondage to decay and brought into the glorious freedom of the children of God" (Romans 8:19–21). The universe is not just teleological, but also, in some way, feelingly mindful of its creator's divine purpose. This, at least, is what sacred writ suggests.

So, to take stock of the foregoing: God wishes to redeem the entire created order, not just humankind, and, what is more, that order has the capacity to rejoice in its creation and long for salvation. Nature, in brief, is caught up in the loving kindness of God's work: in the sheer goodness of that work, which quickens in nature feelings of praise and yearnings for ultimate liberation "from its bondage to decay."

As noted, this outlook is alien to modern thought. Who today would ascribe to nature the capacity to praise the creator and to anticipate deliverance from sin and decay? Even among Christian believers, the sentiment probably seems more poetic than literal, more soft-focus

3. Jeanne Kay, "Concepts of Nature in the Hebrew Bible," in *Judaism and Environmental Ethics,* edited by Martin D. Yaffe (Lanham, Md.: Lexington Books, 2001), 90. Recall Mircea Eliade's claim: "What we find as soon as we place ourselves in the perspective of religious man of the archaic societies is that the world exists because it was created by the gods, and that the existence of the world itself 'means' something, 'wants to say' something, that the world is neither mute nor opaque, that it is not an inert thing without purpose or significance. For religious man, the cosmos 'lives' and 'speaks'" (*The Sacred and the Profane: The Nature of Religion,* translated by Willard R. Trask [San Diego: Harcourt, 1987], 165).

metaphor than hard-edged fact. But this dismissive attitude points up the vast distance between the biblical worldview and the modern scientific stance whose mechanistic metaphysics portrays nature as inert or lifeless.

In this article, I wish to challenge that metaphysics while also recovering the biblical sensibility that nature is alive to the drama of salvation unfolding in its midst. The challenge I offer is straightforward and comes from science itself—the mind-stretching realization of quantum entanglement. This realization does not, of course, imply nature's capacity to experience God's love and respond in kind; nevertheless, by undermining the mechanistic thesis that nature is nothing but a congeries of inert, self-contained bodies, it does clear space for other non-mechanistic understandings.

What I propose is a different reading of reality—a different "likely story," as Plato would say[4]—but a reading that respects both experimental fact and Christian belief. To this end I first explain quantum entanglement and how it undermines the mechanistic metaphysics of classical (pre-quantum) physics. I then address Emmanuel Levinas's belief that reality is grounded in sacrificial goodness, a view that aligns with the Christian doctrine that Christ's passion—his redemptive act of sacrificial love—originates the cosmos and, as Paul says, holds it together: "in [Christ] all things hold together" (Colossians 1:17). They do not hold together, I argue, by means of mechanical interaction, but in virtue of Christ's sacrificial act, the passion of which the cosmos unitarily experiences, at least in some rudimentary way that comports with the biblical sensibility that nature feels both the pain and the joy of Christ's redemptive offering.

That offering, I will suggest, brings all things into sympathetic unity and thereby reconciles all things to one another so that reality coheres as a unitary system. The cosmos, as Paul proposes, is alive in

4. Plato, *Timaeus* (29d), translated by Peter Kalkavage (Newburyport, Mass.: Focus Publishing, 2001), 60.

Christ: it is quickened and held together by the undying efficacy of his redemptive sacrifice.

Refracted through the prism of quantum entanglement, this outlook approximates Abner Shimony's notion of passion-at-a-distance.[5] Shimony proposes that entangled particles *feel* each other across space; their entanglement, that is, is not the result of some sort of action-at-a-distance force that connects inert bodies. What is more, the Christian perspective detailed below echoes Levinas's view that ethics comes before ontology, that goodness precedes being, for when we probe the ontology of entangled particles, we do not find determinate bodies with well-defined ontological properties. Rather we find ephemeral entities whose lack of properties, and consequent lack of ontological self-containment, affords them wide relationality with other such entities—as if nature is ecstatically caught up in the expansive goodness of some world-quickening event.

To see this expansiveness at the micro-level—that is, the entanglement of distant particles—I follow explanations of quantum entanglement offered by Euan Squires and N. David Mermin. Although the explanations are intended for non-specialists, they present "without any distortion one of the most strikingly peculiar features of the atomic world"[6]—this, at least, is Mermin's claim.[7] The puzzle to be addressed,

5. Abner Shimony, "Controllable and Uncontrollable Non-locality," in *Search for a Naturalistic World View,* vol. 2 (Cambridge: Cambridge University Press, 1993), 133.

6. N. David Mermin, "Quantum Mysteries for Anyone," *The Journal of Philosophy* 78, no. 7 (July 1981): 397.

7. I hasten to add that Mermin's explanation is a model of physical experiment, not a description of actual experiment. Better than any other model, however, it helps one grasp the requisite points, in my opinion. Let me also note that in this article I do not rehearse the history of the idea of quantum entanglement, which begins with Albert Einstein's arguments against the Copenhagen interpretation of quantum mechanics developed by Niels Bohr and Werner Heisenberg. There are other interpretations, notably David Bohm's hidden

in my mind, has much to do with sameness and otherness, the focus we put on one thing while disregarding another thing, as if the two things—this and the other—were unrelated. Most of the time we get away with this sort of thinking, but quantum entanglement is an extreme counter-instance, or the point at which the pendulum begins to swing the other way. In his appreciation of the invasive, disruptive essence of otherness, Levinas gave us the means to make wider sense of quantum entanglement. In one way, same and other are unrelatable, for otherness cannot be scaled into sameness. In another way, however, the two are in indeterminate relation, for otherness torques sameness while slicing into it. Somewhere between these two Levinasian considerations, mutual incommensurability and mutual but unsettled relation, between what Levinas calls relation and "relation without relation,"[8] space is opened for a Christian understanding of quantum entanglement.

Introduction to Quantum Entanglement

A very basic description of quantum entanglement proposes that two particles, having once interacted, remain interactively entangled—that is, instantaneously connected—as they move apart from each other. The surprising detail here is "instantaneously connected," for it would seem that as the particles separate, interaction between the two would occur over time. But experiments indicate that this is not the case: entangled particles, no matter how distantly separated, remain timelessly linked.

The puzzle of entanglement is surely, at least in part, a function of the assumptions we make while describing it. In the brief description given above, for example, we assume, or imagine, self-contained (context-free)

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variables interpretation and Hugh Everett's many worlds interpretation. In this article, I follow the Copenhagen interpretation, which is the prevailing understanding among physicists and the interpretation that anticipated quantum entanglement prior to its experimental determination.

8. Emmanuel Levinas, *Totality and Infinity: An Essay on Exteriority,* translated by Alphonso Lingis (Pittsburgh: Duquesne University Press, 2005), 80.

particles flying through space. We most likely further imagine space to be a separating modality, something that, as it gets between things, acts to disjoin them. Later we will have occasion to question these assumptions. For now, however, we merely acknowledge them and get on with the task of explaining quantum entanglement, bearing in mind that the descriptive terms to be employed may be partly responsible for the puzzle that falls out of the explanation.

It is not difficult to grasp entanglement in terms of same and other. As a first approximation, think of two synchronized swimmers. By what means do they stay in synchrony? Someone seeing synchronized swimmers for the first time might assume that these are identically designed and programmed robots. This explanation would trace pair synchronization to pair similarity. The swimmers are clones, both physically and programmatically, and when placed in identical circumstances, they respond the same way to bring off a synchronized pair performance. Let us call this way of explaining the similar behavior of distant entities Scenario 1. Now, if the observer were informed that the swimmers do not share the same programming and are not identically designed, she would have to cast about for a different way of explaining the synchrony. The only other way, it seems, would be to endow the figures with powers of awareness—sensory powers—beyond their physical self-containment. They stay in synchrony partly because of roughly similar, though not identical, design and programming (body selection, conditioning, and training, for example), but also because they monitor each other while performing their routine. The two swimmers, though apart, know what the other is doing in the pool.

This second way of explaining the similar behavior of entities across space we shall call Scenario 2. While Scenario 1 trades on the assumption of repetitive, self-contained similarity, Scenario 2 also posits repetitive similarity though does not wholly depend on it; some of the synchrony will depend on the swimmers' capacity to monitor one another. Or to express the matter differently, Scenario 2 rejects the notion of self-containment

and ascribes synchrony (in part) to an ongoing dialectic of same and other, each swimmer keying off the other.

Something like Scenario 2 happens in quantum entanglement, but with a surprising twist. Unlike swimmers who partly depend upon similar body characteristics to achieve synchrony, particles lack the relevant "body characteristics," or properties, to help them bring off synchrony. They therefore, it seems, achieve synchrony solely by means of each particle's un-self-contained (context-inclusive) openness to the other particle.

I say "it seems" because we do not, in any direct or straightforward sense, see the particles interacting instantaneously. Nevertheless, the indirect evidence, by disabusing us of the assumption that particles innately possess properties, eliminates the possibility of Scenario 1–type explanations and thereby throws us back to Scenario 2. The evidence at hand, in other words, compels explanations that cannot invoke similarity of properties because neither particle possesses the relevant properties, whether similar or dissimilar. Indeed, the particles come off as somewhat disembodied, at least with regard to the properties of interest, and this disembodiment might be seen as a kind of open expanse whereby the particles, though apart, hang together as a unity.[9] Their entanglement is such that neither has snapped into place as a sharply located, determinate entity. This will happen only as one or the other is observed, and then, consistent with their pre-observed (but inferred) entanglement, both snap into place at precisely the same instant. Thus, each achieves individuality or selfhood and thereafter presents itself as a distinct entity

9. The qualifier in this sentence—"at least with respect to the properties of interest"—enables the point that not all properties are regarded as indeterminate prior to measurement. Definite electric charge, for example, is always ascribed to electrons, whether or not they are observed. With regard to the present discussion of quantum entanglement, the critical indeterminate property is position. Where are the twin-state particles? It is reflexive in classical (pre-quantum) physics to think of them as distinctly localized objects, but this assumption breaks down in quantum physics.

cut off from the other. Entanglement, in brief, is not a post-observational phenomenon, for the moment we look at—that is, measure—one particle, entanglement is broken as both particles become self-existing, separate entities. The strange thing is that it takes only one inquisitive glance at one particle to alter the condition of both, even though the particles may be far apart. The glance, of course, is instrumentally mediated, but we build instruments to peek into the micro-world.[10]

To see how this works, and how we know that entanglement is real even though we cannot directly see it, we offer the following two-part explanation. The first part (adapted from Squires[11]) is an analogy that, if understood, will facilitate understanding of the second part (adapted from Mermin[12]) wherein the puzzle of entanglement is straightforwardly spelled out.

First Part

Imagine two people—call them Alice and Bob—locked in separate booths and not allowed to communicate in any way. Every thirty seconds each is given a card that randomly bears the number 1, 2, or 3. Upon this card each indiscriminately writes "yes" or "no" and then slips it into an envelope that is mechanically transferred beyond the booths to a team of analysts. The process is repeated many times, and when the analysts announce their findings, they note that whenever both Alice and Bob received a card with the same number, both wrote "yes" on their cards or "no." There were no mixed responses.

10. Whether human consciousness alone collapses superposition states (as some thinkers have claimed) is a controversial question. I am not suggesting that it does, only remarking that instruments extend our observational reach in purposive ways and thereby instantiate our predilections. We choose what to observe and how to observe it.

11. Euan Squires, *The Mystery of the Quantum World,* 2nd ed. (Bristol: Institute of Physics Publishing, 1994), 183–85.

12. Mermin, "Quantum Mysteries for Anyone," 397–408.

Other than this agreement when similarly-numbered cards were given to the two test subjects, nothing unusual seems to have occurred. Card numbers appear to have been randomly generated, and the incidence of yes and no responses was about even, indicating that neither Alice nor Bob had a bias either way. These facts, however, make the aforementioned agreement all the more striking. How could the two test subjects agree every time they were given the same number, and yet everything else indicates that the subjects are isolated from each other and that card numbers and subject responses are generated in random or unbiased ways?

One analyst proposes that whenever the subjects are given the same number, some kind of telepathic connection occurs to guide them into giving the same response. Another, however, observes that if Alice and Bob had conspired beforehand, the anomalous result is easily explained. All they need have done is to have agreed on working in unison (though incommunicado in the booths) through a given sequence of answer sets. Upon receiving their first cards, for instance, they both answer according to the schema YNY (yes for 1, no for 2, yes for 3). Thus, if both received 2, both would write "no" on their cards. To ensure the random character of their responses (an even number of yes and no responses), they would have to cycle through all possible answer sets (eight in total—six mixed and two homogenous) again and again, but this would not be difficult.

This proposal sounds eminently reasonable, but Alice and Bob heatedly deny pre-test collusion. Not surprisingly, few people believe them. Then a third analyst devises a way to test their claim of innocence. He argues that for any given trial, the probability of their answers agreeing is 50% and this probability carries through to all results. That is, about 1/2 of the results will be either YY or NN—if the test subjects are innocent.[13] If, however, they have colluded there will be a telltale statistical

13. There are four possible answer combinations: YY, NN, YN, and NY. In an unbiased situation, like answers are as probable as unlike answers.

fluctuation away from 1/2. To see what the analyst has in mind, we list the various possible combinations of numbers for any given trial.

11 12 13 21 22 23 31 32 33

Now, assuming collusion on Alice and Bob's part, how would they respond if their agreed-upon answer set were YNY? Aligning YNY with the combinations just listed, we get:

YY, YN, **YY**, NY, **NN**, NY, **YY**, YN, **YY**

I have highlighted the agreements, and they are not hard to count. For mixed answer sets (readers are invited to test other mixed sets), agreement will occur five out of nine times. For homogenous sets, it will occur nine out of nine times. This represents a significant statistical departure from the 50% probability that should prevail if Alice and Bob have not collaborated. So, to get to the bottom of the issue, the analysts need only compare the number of agreements with the total number of trials.

In the macro-world, we would fully expect that the test subjects' conspiracy would be exposed by a tabulated frequency of 5/9 or higher. But this is an analogy illustrating the strangeness of quantum reality, wherein researchers, after running a similar test with particles and puzzling through similar issues, find, to their astonishment, that agreement occurs only 50% of the time. What this means is that two paired particles (whose counterparts are Alice and Bob in the analogy) are not operating from a shared answer set. Or, more generally, the particles do not each possess some common property that accounts for their identical responses when isolated from each other and subjected to identical treatment. How, then, are the two identical responses produced? Not, as I just said, on the basis of a common answer set or common property, but on the basis of the hypothesis ruled out earlier—something like a telepathic connection. If pre-test collusion is conclusively ruled out, then we must fall back on the only other conceivable explanation, even if that explanation staggers belief. Either that or come up with a third explanation, which is what I propose to do in this article.

Second Part

In the analogy, a shared answer set implies that Alice and Bob's answers will agree at least five out of nine times, on average. If, however, they are not sharing an answer set—that is, not working through a sequence of sets—agreement should occur about one-half of the time. Given enough trials, it is easy to distinguish between the two possibilities, and, paralleling the realization of quantum entanglement, analysts discover fifty percent agreement, which leaves them baffled by the agreement that invariably occurs when the subjects are given similarly numbered cards. What could possibly cause such agreement, if not shared answer sets instructing them to behave similarly (write the same answer) when given similarly numbered cards?

In quantum experiments, two particles originating from a common event are sent toward oppositely situated detectors, one on the left and the other on the right of the particles' point of origin (see Figure 1). The detectors are randomly set (and randomly re-set after every trial) to measure a particular particle property, and if the settings are identical, measurement results are identical—as indicated by flashing lights of the same color, green or red. This invariable agreement would lead us to believe that any two particles—what are called paired particles or particles in a twin state—share a common answer set. That is, they are, with regard to the property of interest, exactly alike, and this is why, when subjected to similar treatment (identical detectors set to the same measurement setting), they produce the same measurement results.

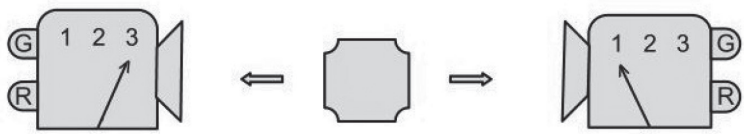

Figure 1. Paired particles are sent in opposite directions from a central emitter. The particles are measured by detectors randomly set at one of three possible measurement settings, whereupon a green or red light flashes indicating the measurement result.

This belief is merely an inference, but it seems a very good one. Will it, however, carry through to measurements where detector settings are different? To see, we must unpack the inference and test it. The detectors measure the particles at three settings, and if paired particles share common answer sets, we must list the possible answer sets and then align them with all possible combinations of settings to predict the frequency of measurement-result agreement. This may seem a tall order, but we already did this in a preliminary way while working through the analogy. What follows is just a bit more detailed.

First, the possible answer sets. Since there are three settings on the detectors, each set will consist of three answers. In quantum experiments, the answers are binary: the particle behaves one way or the other (as indicated by the green or red light in Mermin's explanation). So, we can express these answers sets exactly as we thought of them in the analogy. An answer set of YNY means that if the detector setting is 1 or 3, the particle will behave one way, and if the setting is 2, it will behave the other way. Listing the possible answer sets, we get eight in total.

YYY, NNN, YYN, YNN, YNY, NNN, NNY, NYY, NYN

We note that the first two answer sets are homogenous, and the remaining six are mixed. If paired particles share a homogenous answer set, agreement will occur regardless of what the detector settings are. For the mixed sets, it will occur 5/9 of the time, as demonstrated earlier. The reader will recall that the mixed sets, when aligned with the nine possible setting combinations (11, 12, 13, 21, 22, 23, 31, 32, 33), produce a prediction that is at odds with the prediction that obtains when we imagine the particles not sharing answer sets. In the first case, we expect at least 5/9 agreement ("at least" because once we factor in the homogenous answer sets, the probability of agreement increases); in the second case, 1/2 agreement.

Tabulating the data to determine which prediction is correct, we find 1/2 agreement, which falsifies our inference of shared answer sets. But, to

repeat what must now be an old refrain, how do paired particles produce similar results when subjected to similar treatment if they are not in some way similarly structured? With the commonsensical inference falsified, the only option available, it seems, is to posit something like a telepathic connection between the two particles, one that guides them to behave similarly in similar circumstances. This explanation, I feel, is only slightly better than the falsified inference. A much better picture—one that comports with quantum mechanics' characterization of the particles—emerges from Levinas's depiction of self-other interchange.

Levinas on Self and Other

Emmanuel Levinas proposed that otherness is irreducible to self or sameness. By rupturing sameness, the glance of the other opens the self outward and thereby keeps it from spiraling in on itself toward stasis—endless replay of the same. Put differently, Levinas felt that otherness cannot be scaled into being, at least as being had been imagined by Heidegger, Hegel, Descartes, and other Western thinkers who saw it as self-contained totality. The better model for Levinas, the one coinciding with pre-reflective experience, is being as open economy, a system invariably shattered by otherness and therefore a reality both immune to the totalizing grasp of intellectual thought and disruptive of it. In this sense, otherness is not scaled into self-same being; its metric, incommensurable with being, is originative of what Levinas called "otherwise than being."

What has this to do with quantum entanglement? My thesis is that quantum entanglement may be understood in terms of Levinas's view of self-other interchange, and that Christ's passion is the originary instance of all such interchange. Granted, Levinas was not concerned with the interaction of elementary particles, but it is here, I propose, that some of the effects he described register dramatically. The intersection of same and other—of one thing and an*other* thing—and the resulting Levinasian difference as otherness slices into sameness, show up at a

granular level to affirm his point that otherness is integral to reality. So integral, in fact, that the identity of one particle cannot be disentangled from the other. Analogously, I submit, each person's self is shot through with the otherness of other selves, despite our inclination to regard each self as a separate, self-contained, distinctly localized totality.

In principle, it would seem that every social encounter, even when strangers briefly lock eyes while passing on a busy sidewalk, should leave a mark, however tiny, on the participants—should change them, however slightly. And because social encounters are relational and reciprocal, they are instances of identity interchange, the trading of self and other as each participant takes in otherness from other participants. However, because we tend to think of ourselves as self-contained unities, we further imagine that our relations with others are merely external—like two billiard balls that, after colliding, move apart from each other essentially unchanged. This, of course, is a simile from Newtonian physics.[14]

14. The doctrine of external relations coincides with the mechanistic metaphysics of Newtonian science, but it is an attitude that, upon blinking away a great deal of ordinary experience, leads us astray, according to Alfred North Whitehead. For one thing, it leads us into the fallacy of simple location. "Science and philosophy," wrote Whitehead, "have been apt to entangle themselves in a simple-minded theory that an object is at one place at any definite time, and is in no sense anywhere else." But the testimony of everyday language, while "naively expressing the facts of experience," is quite different. "Every other sentence in a work of literature which is endeavouring truly to interpret the facts of experience expresses differences in the surrounding events due to the presence of some object." What this implies, concluded Whitehead, is that an "object is ingredient throughout its neighborhood, and its neighborhood is indefinite" (Alfred North Whitehead, *The Concept of Nature* [Mineola, N.Y.: Dover, 2004], 145). Thus, at a level beneath the radar of mechanistic science, events intermingle, irrespective of space and time intervals. "In a sense, everything is everywhere at all times. For every location involves an aspect of itself in every other location. Thus every spatiotemporal location mirrors the world." Further: "If you try to imagine this doctrine [the mutual immanence of all things] in terms of space and time, which presuppose simple location, it is a great paradox. But if you think of it in terms of our naïve experience, it is

Comparable tropes drawn from quantum mechanics are often messier. As we shall see, the notion that two things, having once interacted, then straightforwardly move apart from each other is thrown into question. What is more, it is hard to sustain the view that they move apart from each other essentially unchanged. Speaking of particle interactions, Giancarlo Ghirardi writes: "Practically every interaction brings with it a loss of identity of the systems that are interacting"—a loss of original identity, that is, owing to the interaction of particles.[15]

Analogously, I submit, the same thing occurs as humans interact.[16] Further, it happens in a Levinasian way: upon rupturing self, otherness fosters a relational unity between two persons, one that survives the encounter, no matter how brief or casual. At the macro-scale of everyday experience, this survival is easily overlooked: we often feel ourselves unscathed by human interaction, particularly when it is brief and casual. At the micro-level, however, we find evidence of change. That is, we find identity interchange and indissoluble reciprocity, not self-contained entities blithely moving apart from each other. The *interaction* of the particles—that is to say, the merging of previously unrelated particles into a single event—lives on as counter-propagating particles thereafter remain entangled. The interaction, one might venture, confers on the particles a single shared identity, albeit one that lacks definite configuration or stasis.

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a mere transcript of the obvious facts" (Alfred North Whitehead, *Science and the Modern World* [New York: The Free Press, 1967], 91–92).

15. Giancarlo Ghirardi, *Sneaking a Look at God's Cards: Unraveling the Mysteries of Quantum Mechanics* (Princeton, N.J.: Princeton University Press, 2005), 190. Directly following this statement Ghirardi writes: "But since in the long run everything in practice interacts with everything, what emerges is a vision of the universe as an 'unbroken whole,' an undivided unity whose parts no longer have any identity. The theory implies a fundamentally holistic vision of the universe" (190).

16. The word "analogously" is critical here. While researchers continue to demonstrate entanglement with ever larger objects, I do not insist that quantum entanglement scales up to define human interaction. Nevertheless, something analogous occurs.

This latter proposition—the unsettled, indeterminate nature of the shared identity—affirms Levinas's point that otherness is disruptive. It is, moreover, a response to one of the great philosophical conundrums of quantum mechanics: whether God, as Albert Einstein wondered, plays dice with the cosmos. Einstein rejected the notion of God's playing dice; he preferred a determinate, non-chanceful universe. After Einstein's death, however, physicists found a way to test this metaphysical preference. Thereby they discovered an entangled, indeterminate reality, a reality teeming with otherness. Observing one particle, they learned, entails observing (affecting) its distant counterpart. The two particles—the one selected for observation and the other momentarily ignored—are a single package, evidently because, in virtue of a previous interaction, the identities of both particles are indeterminately mixed. The interaction shuffles the two identities together so that neither particle emerges unscathed. That is, neither emerges as a distinct particle, cleanly localized and cut off from the other. The interactive unification of the particles persists beyond the interaction per se, making them a single unity even as each flies away from the other.

Same and other, Levinas might say, are interactively mixed so that neither participant moves away unscathed. Each has been indeterminately unsettled by the encounter through identity interchange; that is, through mutual exchange of otherness. In human relations, as noted, the exchange may be proportionally tiny and consequently all but imperceptible. At a finer-grained level, however, the binding power of the interaction is more in evidence than the assumed self-containment or localization of the involved participants, neither of which is separable from the other.

Why Levinas?

In the literature one frequently encounters the term "telepathic connection" or something like it to explain quantum entanglement. Insofar as this expression conjures up an image of two distinct, distantly-separated particles timelessly interacting, it is misleading. The mathematics of

quantum mechanics notates the particles as a unitary system, the two particles being *interdependently* suspended or superposed over a range of possible measurement values. When measurement occurs, consequently, the observation of either particle mathematically entails the observation of the other. But not, I submit, because the two particles are distinct, self-contained entities somehow telepathically connected across space. Rather because the particles are indeterminate to the point of leaning into each other for their delicate, co-evolving ontology.

In brief, particles prior to measurement are wave-like, and waves, classically understood, are nothing in and of themselves. Instead they borrow their reality from other things; they are the wave action of those things, and wave action suggests widely-extended, relational inclusivity rather than particulate, point-like exclusivity or self-containment. Wave action also connotes ongoing action or becoming, in contrast to the notion of particle stability, which has, until recent decades, prevailed in the West. In quantum theory, this picture is qualified and, it seems to me, deepened, by the realization that the wave associated with a particle represents the probability of finding it at a particular location. The particle, that is, is intrinsically probabilistic, at least with respect to its position (and several other properties that need not concern us here). One way of grasping quantum entanglement subsists in the realization that, prior to measurement, particles are unbounded portions of each other, not just by reason of their wide wave-like extension but, more fundamentally, by reason of their probabilistically indeterminate positions.

Although the analogy is far from perfect, this is a bit like saying that a pencil is "to the left." To the left of what? Once the location of the second term is specified, the first term's location—the pencil's—is as well, the point being that each term depends on the other for the specification of its position. More generally, no object is fully self-specifying because some of its properties remain indeterminate until other objects are specified. A stock-in-trade example is motion. To ascribe motion to one thing is to relate it to another thing. All motion is relative, which means that all

motion is, at least, a two-body affair. The idea of one thing moving with only itself as a reference point is incoherent and has no place in science.

The analogy is imperfect because when it comes to things like pencils, we invariably experience them as parts of a great relational web of objects (chairs, countertops, staplers, etc.), the whole of which specifies their position, motion, and so on. They have already borrowed a great deal of reality from their environment and have stabilized to the point that we do not see them as indeterminate entities. Unmeasured particles similarly swim in a sea of borrowed—or better, unclaimed—reality, but they have not stabilized as distinct, determinate entities. Again, to call them "particles" is to misconstrue them, for that suggests local self-containment, which in turn implies that particles exist independently of each other. But if this were the case—if unmeasured particles intrinsically possess properties enabling their context-free self-existence—we would have gotten 5/9's agreement in the aforementioned experiment rather than 1/2.

The quantum-mechanical term that best marks the profound difference between observed pencils and unobserved particles is *superposition.* A pencil is said to occupy a definite position, or to have a definite state of motion, which means that it cannot simultaneously occupy two different positions or move at two different velocities (from a given vantage point). Unobserved particles, by contrast, are probabilistically superposed across a range of position values (all mutually exclusive from a classical point of view) or across a range of velocity values. Thus, they lack the kind of definite properties that would afford them self-existence—that would give them a hard edge vis-à-vis other things. And without that edge the world cannot crystallize as an aggregation of distinct things, all separately laid out in space and time.

If we take this point seriously—that the indeterminate nature of unobserved particles militates against our presupposition of self-contained particles spread out in space and time—then we take a big step toward grasping why quantum entanglement entails spaceless, timeless

interactions. In their ontology, those particles express the very grammar of reality that quantum experiments subsequently verify. They are not self-bounded, context-free objects; instead they are diffuse, open, and unsettled or indeterminate. To borrow a thought from Levinas, they are passive—that is, expansively responsive—to the point of vulnerability. Lacking protective self-containment, they register the world.

Abner Shimony, one of the first to propose the tests that confirmed quantum entanglement, coined the phrase "passion at a distance" to express his conviction that entangled particles *feel* each other across space. The older (and still prevailing) way of thinking about entanglement is in terms of "action at a distance," a phrase that plays to classical sensibilities by triggering the thought of two counter-propagating particles remaining instantaneously connected, notwithstanding their self-isolation. This outlook has engendered the expression "non-locality" because if the particles really are isolated from each other, each confined to a different locality, then their interaction must be "non-local" owing to its timelessness—that is, its indifference to the distance that separates the localized particles. But, as noted, unobserved particles lack properties that would secure their self-isolation or self-localization, so the proposition of action-at-a-distance contact founders on the realization that each particle is an open, unbounded portion of the other. The question of intervening space between particles, in other words, is foreclosed by ontological considerations. Neither particle has the capacity—the definite, hard-edged properties—to cut itself off from the other.

As Don Howard states in his assessment of Shimony's proposal, "'passion at a distance' is all about tendency and propensity, not the concreteness whose misplacement in the realm of the physical was lamented by Alfred North Whitehead."[17] The fallacy of misplaced

17. Don Howard, "Passion at a Distance," in *Quantum Reality, Relativistic Causality, and Closing the Epistemic Circle,* The Western Ontario Series in Philosophy of Science, vol. 73, edited by Wayne C. Myrvold and Joy Christian (Amsterdam: Springer, 2009), 3.

concreteness occurs when we concretize what, for all we really know, is merely a tendency or aspect of the world. In the eighteenth century, for example, heat was thought to consist of particles whose collective motion was fluid-like; thus, it was said that heat flowed from hot to cold bodies, independently of the atoms that composed those bodies. Researchers later realized that heat is merely the action of atoms—that is, their tendency to move more quickly as they absorb energy.

In one way, this shift in understanding parallels the shift that occurs when we switch from an action-at-a-distance interpretation of quantum entanglement to a passion-at-a-distance interpretation. The former interpretation concretizes the particles; the latter backs off from that concretization to engender a vision of reality wherein action occurs by the grace or courtesy of other things. In the latter model, however, there are no hard-edged, atom-like "other things" to receive the properties that were once said to reside in the particles, now grasped as probabilistic, wave-like tendencies. It is easy, that is, to relocate the origin of heat in the energetic motion of atoms because this relocation merely amounts to finding a new locus of concretization, the hard-edged atoms which we then take to be ontological bedrock. With entangled particles, however, there is no new locus of concretization, no new stable bedrock.

To express the matter in a Levinasian register, there is no point at which the self-other dialectic settles down or stabilizes because the evaporative boundary between self and other is a conduit for indeterminate identity interchange. Said simply, when it comes to self-other relationality, concreteness is always misplaced: there is no concrete self or other.

But, aside from this parallelism, how might Levinas help us understand quantum entanglement? My submission is that the passion-at-a-distance model of quantum entanglement reenacts Levinas's conviction that existence is, at bottom, an ethical affair. It is not an ontological matter, a matter of distinct things in mechanical or even telepathic interaction, although this is how it might look at what Maurice

Merleau-Ponty called the second-order, scientific level.[18] Rather it concerns relations, reciprocities, and, most importantly, *vulnerabilities*—this is where the phase change occurs as ontology passes into ethics. The word *passion,* that is, is not a clumsy adaptation from subjective experience, but an apt hint that subjective experience—or ethical, intersubjective experience—may be rewardingly mapped onto the deepest puzzle of quantum mechanics.

The Mapping

At issue is the word *passion.* May we lift this word out of its human context and relocate it in the seemingly alien context of quantum particles? Well, Shimony has already done this, although probably with the caveat in mind that entangled particles do not actually feel as humans do. Nevertheless, the words *feeling* and *passion* lie at the nub of his outlook and are unavoidable in its articulation. Howard, for instance, contrasts the passion-at-a-distance view with the other available options by saying: "It is neither the local causality of pushes, pulls, and central forces familiar from classical mechanics and electrodynamics, nor the non-local causality of instantaneous or just superluminal action at a distance. . . . This mode of connection of entangled systems has them feeling one another's presence . . . but not in a way that permits direct control of one by the manipulation of the other."[19] More simply, and employing the Alice-Bob terminology used above, Richard Gill states that passion at a distance "expresses that though there is no action at a distance (no manifest non-locality), still quantum physics seem to allow the physical system at Alice's site to have some feeling for what is going on far away at Bob's."[20]

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18. Maurice Merleau-Ponty, *Phenomenology of Perception,* translated by Colin Smith (London: Routledge, 1999), viii.

19. Howard, "Passion at a Distance," 3.

20. Richard D. Gill, "Better Bell Inequalities (Passion at a Distance)," *Asymptotics: Particles, Processes and Inverse Problems: Festschrift for Piet Groeneboom,* Lecture

It is a commonplace that quantum physics has debunked the scientific ideal of objectivity, which assumes that human observers may carefully step back from nature so as to leave it unaffected by their inquiring presence. Quantum entities are so delicate that even the most carefully contrived experiment introduces an uncontrollable disturbance to the system being observed. More than that, those entities are delicate in the sense that they lack certain determinate properties (like position) that would allow them to be fully free of contextual influence. Unobserved quantum reality is hence vastly more contextual and relational than the picture of reality we routinely summon up when imagining atoms, electrons, and photons.

The realization that unobserved atoms exist as they mirror context, or exist as relational crisscross points, is surprising enough; the bigger follow-on proposal posits human consciousness as an integral aspect of an atom's context. As Freeman Dyson puts it, "The laws [of physics] leave a place for mind in the description of every molecule."[21] This statement marks quantum mechanics' uneasy relation with cognitive science—uneasy because puzzles such as quantum entanglement blur the Cartesian divide between the physical and non-physical sciences. After quoting Eugene Wigner to the effect that "it was not possible to formulate the laws of quantum mechanics in a fully consistent way without reference to consciousness," Bruce Rosenblum and Fred Kuttner write: "Nevertheless, the physics community does not accept the study of consciousness itself as part of our discipline. And that is appropriate. Consciousness is too ill-defined, too emotion-laden. It is not the sort of thing we deal with in physics. But discussion *relating* quantum mechanics and consciousness will not go away."[22]

Notes–Monograph Series, vol. 55, edited by Eric A. Cator, et al. (Beachwood, Ohio: Institute of Mathematical Statistics, 2007), 138.

21. Freeman Dyson, *Disturbing the Universe* (New York: Harper & Row, 1979), 248–49.

22. Bruce Rosenblum and Fred Kuttner, *Quantum Enigma: Physics Encounters Consciousness* (New York: Oxford University Press, 2006), 5. Original emphasis.

The discussion will not go away because, as the early part of this article proposed, with respect to certain properties, particles are expansively indeterminate—ontologically unsettled and un-self-contained prior to observation—that is, prior to the moment they consciously register for us as determinate objects. When we undertake the measurement of a particle, that measurement appears to trigger a particle's collapse from wave-like openness to point-like particularity, and, more than that, the collapse may be widely embracive of other (wave-like) particles owing to their ontological fragility and consequent relational vastness. By observing particles, by making them the centers of our interest, we seem to center or self-center them; we seem to endow them with properties that answer to the pinpoint, reductionistic curiosity we project into the world.

Really, this is more of an epistemological point than an ontological claim. We may assert that decisive events (measurement events) occur when particles interact with inanimate instruments, but those instruments instantiate human intentions. The cut, therefore, between sentience and non-sentience is less clear and more problematic than generally assumed. Further, although current thinking may favor the stipulation that inanimate instruments trigger the collapse of wave-like particles, we cannot know this from the point of view of the lifeless instrument but only from our own conscious point of view. Given this inevitability, it is not surprising that "discussion *relating* quantum mechanics and consciousness will not go away."

More to the point at hand, if we allow that consciousness—so "ill-defined" and "emotion-laden," as Rosenblum and Kuttner insist—entails subjectivity, it becomes difficult to keep words like *passion* and *feeling* out of the discussion. Further, any step toward subjectivity is a step toward the intersubjectivity of human relationships and the aspiration to ground those relationships to ethical principles. As remarkable as this proposed "ethical turn" might sound, it is a possibility that cannot be dismissed out of hand. The ontology of

self-containment, so informative of the way we imagine the world, fuzzes out at the quantum level to reveal a vast and tremulous skein of relations: a skein that seems to be observer-inclusive and therefore delicately responsive to human choice and predilection.

In brief, the following considerations suggest that quantum ontology entails and passes into ethics: the dissolution of independent objects, the concomitant descent into profound relationality, the materialization of distinct (determinate, self-contained) reality that occurs as human consciousness selectively actualizes tendencies from a vast menu of possibilities (the so-called collapse of the superposition upon observation), and the tremendous responsibility that would seem to occasion this materialization. Even if consciousness or observation does not trigger superposition collapse, the fact remains that quantum mechanics demonstrates that we are deeply participatory with nature rather than aloof from it. We are more cognate with nature than we once assumed, and this fact prompts the suggestion that nature may have, like humans, a teleological or ethical arc.

In any case, once we get around to inspecting the ontological ground of the world, we find that it is indeterminate and quivering with manifold possibility; further, we find that things are not sharply localized but instead are relationally intertwined; finally, we discover that the interest we direct toward nature appears to trigger the collapse of relational webs (superpositions) so as give us the localized objects of everyday experience and the firm ontological ground that we were seeking in the first place. Beneath this ground, however, reality appears not so much being as coming-into-being. It is still innocent of what it might yet be, still in the throes of creation. It is indeterminate or, to borrow a phrase from Genesis, mostly "formless and empty" (1:1).

This is reality before the onset of ontology, before things stabilize as ontological fact. Levinas, by valorizing the indeterminacy of human relations, gives us the world in the dawning twilight of its creation—a twilight still invasive of ontological daylight wherein things are neatly

spread out as separate objects in space and time. More than that, however, Levinas points us toward an originary event, the primal reality of which is uncurtailed by subsequent history. This event cannot be lost in history—cannot be tucked away in the past—because it initiates history and consequently cannot be reduced to what follows in its wake and what it, in fact, endows with value. This event is the immediacy of reality: the flash of pain, Levinas might say, that occasions the world's birth and that, owing to its piercing, searing immediacy, is fully felt but not in the least grasped.

By proposing that entangled particles feel one another, Shimony's passion-at-a-distance interpretation subverts, however hesitantly, the longstanding metaphysical tradition that assigns primacy to inert, unfeeling atoms, so imagined, or their constituents. And once this subversion gets underway—that is, once we allow that elementary particles might feel each other across spacetime intervals—then the ontological ground upon which pre-quantum physics was erected begins to crumble. Not only that, but feeling or passion becomes originary. According to Levinas, the primal, founding event—the ethical big bang, as it were—involves:

> vulnerability, exposure to outrage, to wounding, passivity more passive than all patience, passivity of the accusative form, trauma of accusation suffered by a hostage to the point of persecution, implicating the identity of the hostage who substitutes himself for the others; all this is the self, a defecting or defeat of the ego's identity. And this, pushed to the limit, is sensibility—sensibility as the subjectivity of the subject. It is a substitution for another, one in the place of another, expiation.[23]

This event, this primal expiation or substitution for another, not only founds our concern for others but obliges it as well. We exist in its wake and by its grace, as recipients of its goodness, and that goodness, while initiating history, is not reducible to it. The expiation, Levinas insists,

23. Emmanuel Levinas, *Otherwise than Being, or, Beyond Essence,* translated by Alphonso Lingis (Pittsburgh: Duquesne University Press, 1998), 15.

"burns the sacred groves in which the echoes of the past reverberate."[24] Further: "To reduce good to being, to its calculations and its history, is to nullify goodness. . . . Goodness gives to subjectivity its irreducible signification."[25]

The inclination to see being (ontology) as foundational and exhaustive, says Levinas, is the inclination "to forget what is better than being, that is, the Good."[26] It is also the inclination to forget the eruptive immediacy of the world, the blitz of newness and significance that hits us at every moment. Upon rupturing the sway of being, this quantum-like blitz newly and discontinuously enacts the Good.

"How quickly does the cloudfire streak the sky / Tremble on the peaks, then cool and die?" asked the poet.[27] Cooling and dying is the story of being, said Levinas, but "the primordial intrigue of time"[28] is bound up in the inexhaustible meaning that overflows this simple story. At every moment, expiatory goodness slices into being, exposing it to otherness and investing it with transhistorical significance. This is how "the light comes about by the instant falling out of phase with itself"[29] so that time, contrary to its scientific characterization, is not merely devolution toward perfect stasis or thermodynamic equilibrium. It also expresses the rapture of goodness associated with a world-originating expiatory substitution, and that rapture is always exclamatory; it does not cool and die.

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24. Levinas, *Otherwise than Being,* 18.

25. Ibid., 18.

26. Ibid., 19.

27. Clinton F. Larson, "To A Dying Girl," in *The Lord of Experience: Poems* (Salt Lake City: Promised Land Publications, 1968), 21.

28. Emmanuel Levinas, *Time and the Other,* translated by Richard A. Cohen (Pittsburgh: Duquesne University Press, 2008), 103.

29. Levinas, *Otherwise than Being,* 9.

The Levinasian rupture of being, in other words, is also rapture, a catching up or catching away to otherwise than being. This catching away to otherness, I submit, shows up in the interaction of entangled particle pairs. Neither particle determinately self-exists; rather, each is expansively open to the other, so much so that neither particle may be said to be a local entity endowed with its own properties and consequent self-identity. Indeed, as Shimony proposes, the particles are not mechanically interacting across space and time; instead they seem to be feeling or somehow interchanging with each other. Lacking the inner content, the self-content—the intrinsic properties—that would stabilize them and shelter them from context, they are enormously vulnerable to so-called outside reality or otherness (so-called because their ontological delicacy scarcely affords an inside-outside distinction). This vulnerability, I submit, accounts for their ontological vastness, but it is born of the expiatory goodness that Levinas identifies. The wounding, the outrage, the substitution, and the "passivity more passive than all patience" that attended that originary event are mirrored in the vulnerability of entangled particles—that is, in their self-less openness to each other. This is not action at a distance, the push-and-pull of distant particles, each of which is its own center of force. Rather, it is passion at a distance, a world in the throes of creation, a birth-shocked world, and therefore one in which feeling has not cooled as impersonal force to be parceled out among localized particles.

To follow Levinas, this is the "saying" of the world, not the "said." Saying entails exposure, "stripping [the self] of every identical quiddity, and thus of all form, all investiture, which would still slip into the assignation."[30] Something like this occurs as we, in the wake of quantum entanglement, vainly try to picture unobserved particles as possessing their own properties and therefore their own quiddity. No property is at hand to "slip into the assignation." This exposure, says Levinas, is

30. Levinas, *Otherwise than Being,* 49.

"passivity," or having no "shell to protect oneself," no façade, no persona, not even a "complexion." This is being as "de-nuding" and "vulnerability," and the upshot of this exposure is shock and outrage that keeps being from centering itself, from self-centeredness. This "nudity more naked than all destitution" triggers being's non-coincidence; that is, a destabilizing shudder or "diachrony of the instant" whereby otherness ruptures being so that the entire significance and tenor of reality is that of "one-penetrated-by-the-other."[31]

Or: one substituted for the other, the world-originating expiation that Levinas insists is never intellectually processed, never tamed by cognition or reflection, never thematized. This is because the expiatory substitution is not a matter of enduring until release or redemption, but of enduring with no prospect of release—of feeling completely abandoned, but yet enduring. It accordingly involves an unselfishness unto perfect lassitude whereby the self is evaporated away. Further, because in its "burning for the other"[32] the expiation burns away all basis for self-consummation and even "the ashes" or memory of its own self-sacrificing goodness, there is no risk that the always-novel expansion of reality by the grace of otherness will ever be curtailed. The secret spring of the world will always be "for-the-other," not "for-oneself."[33]

Substitution, that is, enables the world's signification, its meaning: alterity is the arrow of significance. It also, says Levinas, is the wellspring of temporalization. The de-phasing of the same by the other triggers the slippage of time, which may strike us as mere recurrence of the same but whose primordial intrigue is renewal or re-now-al, the exclamatory catching away and exposure of self-same being to otherness. Time thus possesses both a destructive and redemptive edge. On the one hand, it is irreversible passage into physical decline and death; on the other,

31. Ibid.

32. Levinas, *Otherwise than Being,* 50.

33. Ibid.

it entails the spark of otherness that, however fleetingly, lights up the living immediacy of the now.

I am proposing that quantum entanglement comports with Levinas's description of reality prior to measurement and conceptualization. This is a reality that, to some surprising and significant degree, is in the thrall of the other, whether we consider elementary particles or, as Levinas did, human beings. Said differently, this is a reality that cannot be reduced to self-contained, self-same entities that then impinge upon each other by means of external forces or relations. By *external* I mean incidental—that is, forces or relations thought to arise in the aftermath of an entity's self-existence. Such connections, which many reflexively invoke while trying to make sense of reality, have no place in Levinas's thought and little credibility in quantum physics. The better outlook assumes that an entity's relation with the world is part of the entity itself. As Ilya Prigogine and Isabelle Stengers put it, physics "now recognizes that, for an interaction to be real, the 'nature' of the related things must derive from these relations, while at the same time the 'relations' must derive from the nature of the things."[34]

Implicit in this understanding is the rejection of the action-at-a-distance interpretation of quantum entanglement, an interpretation that sees relation as incidental to self-existent objects. Passion-at-a-distance is closer to the mark because it implies feeling, and feeling suggests the organic interpenetration of entity and relation that Prigogine and Stengers posit. It moreover suggests primitive awareness of the world, or awareness arising from the eruptive immediacy of a world that is innocent of individual things separated by space and time. Thus, quantum entanglement is scarcely like mental telepathy, to which it is often compared, but more like feeling before it begins to contract egocentrically. That is, it is more like what Milan Kundera calls "emotional telepathy," which answers to Shimony's notion of passion-at-a-distance.

34. Ilya Prigogine and Isabelle Stengers, *Order out of Chaos: Man's New Dialogue with Nature* (Toronto: Bantam Books, 1985), 95.

Kundera observes that where there is compassion in the sense of co-feeling there is not just ability "to live with the other's misfortune but also to feel with him any emotion—joy, anxiety, happiness, pain." Compassion in this broader sense is not just pity or condescending sorrow, but "the maximal capacity of affective imagination, the art of emotional telepathy. In the hierarchy of sentiments, then, it is supreme."[35] This is where feeling diverges to infinity, or where, to follow Arthur Schopenhauer, compassion dissolves "the distinction between self and not-self."[36] More precisely, this is the moment before that distinction takes effect. To adapt a term from modern cosmology, quantum entanglement marks a moment of inflationary feeling, an expansive, compassionate, unitarily felt moment that yet shows up as we probe the tiniest parts of reality. In the extreme instance where those parts are separated from each other and then tested for separability, they register non-separability—the primeval moment of universal feeling or passion. Lacking properties that would set them apart as parts, they exclaim the simple pre-part rapture of being.

If Levinas is right, that rapture is the ethical matrix from which the world materializes as a part-structured ontological system. But the primordial event, the rupture of being by otherness and the consequent newness or nowness of reality, never grows old, never cools and crystallizes as a system. And since that event is expiatory, it is irreducibly relational. Thus, finding one thing invariably entails finding another; measuring one particle invariably entails measuring its entangled twin. Indeed, the knife—the experimental apparatus—that would separate the

35. Milan Kundera, *The Unbearable Lightness of Being,* translated by Michael Henry Heim (New York: Harper & Row, 1984), 19–20.

36. Arthur Schopenhauer, *On Human Nature,* translated by T. Bailey Saunders (Adelaide: The University of Adelaide, 2014). Web edition published by eBooks@Adelaide and available at http://ebooks.adelaide.edu.au/s/schopenhauer/arthur/human/chapter1.html.

two particles is itself drawn into their entanglement. It thereby becomes lost as a distinctive thing in the pre-part, for-the-other, relational flow of expiatory meaning.

A Christian Perspective

I have argued that the passion-at-a-distance model of quantum entanglement lines up with Levinas's belief that human experience is deeply informed by otherness. In physics, the measured particle is in the thrall of its distant, unmeasured twin, its other, and that is why neither particle is determinately self-centered prior to measurement. In human experience, otherness is similarly disruptive of self-centeredness, the complacency of which Levinas called self-same being. In virtue of otherness, then, neither humans nor unobserved particles can settle down to ontological monotony or endless replay of the same. What is more, according to Levinas, otherness springs from some world-founding, for-the-other, expiatory event, a moment of sacrificial goodness that is prior to being and also subversive of being as a self-contained, self-centered system. Keying off of Shimony's passion-at-a-distance interpretation of quantum entanglement, I have suggested that physics visits that moment of unitary passion or feeling every time paired particles are found to be unitarily entangled.

Levinas describes the expiatory event in searing detail but does not explicitly link it to a religious tradition, though his Jewishness no doubt played a seminal role in his conceptualization, or invocation, of the event. Levinas spent most of the Second World War in a Nazi prison camp as a French military officer. He thus came to know the Holocaust firsthand, particularly when upon his release he learned that his father and brothers had been shot to death by Hitler's *Schutzstaffel.* His mother-in-law, also Jewish, was sent to an internment camp just outside of Paris, and then, perhaps, farther east to a death camp. In any event, she did not return after the war. Scholars agree that these personal devastations, along with

the collective horror of the war, figure into Levinas's concern *with* the other, which transmutes into an ethical imperative of concern *for* the other. "I am responsible for the Other without waiting for reciprocity, were I to die for it," he wrote. "Reciprocity is *his* affair," not mine.[37]

For Levinas, this personal obligation of concern for the other, even if it remains unrequited and even unto death, springs from the world itself—that is, from the expiation or substitution for the other that brings the world into existence and keeps it in exclamatory process. In the Christian tradition, concern for the other is paramount, a fact readily acknowledged by Levinas in his affirmation of Christ's description of the last judgment, wherein people are blessed or cursed according to their treatment of others. The surprising turn comes when Christ states that "whatever you did for one of the least of these brothers of mine, ye did for me" (Matthew 25:40). Reflecting on this passage, Levinas wrote:

> When I speak to a Christian, I always quote Matthew 25; the relation to God is presented there as a relation to another person. It is not a metaphor; in the other, there is a real presence of God. In my relation to the other, I hear the Word of God. It is not a metaphor; it is not only extremely important, it is literally true. I'm not saying that the other is God, but that in his or her Face I hear the Word of God.[38]

The Christian ideal of caring for others, even when that care is unrequited, springs from Christ's love, which is redemptive because it is not premised on reciprocity. "This is love, not that we loved God, but that he loved us and sent his Son as an atoning sacrifice for our sins" (1 John 4:10).[39] The atoning sacrifice entailed the passion or agony of Christ, a

37. Emmanuel Levinas, *Ethics and Infinity,* translated Richard A. Cohen (Pittsburgh: Duquesne University Press, 1985), 98. Original emphasis.

38. Emmanuel Levinas, *Entre Nous: Thinking-of-the-Other,* translated by Michael B. Smith and Barbara Harshav (New York: Columbia University Press, 1998), 110.

39. Compare Levinas: "This antecedence of responsibility to freedom would signify the Goodness of the Good: the necessity that the Good choose me first before I can be in a position to choose, that is, welcome its choice. That is my preoriginary *susceptiveness.* It is passivity prior to all receptivity, it is transcendent.

passion that Isaiah portrayed as a sacrificial substitution of self for the other. "Surely he took up our infirmities and carried our sorrows. . . . [H]e was pierced for our transgressions, he was crushed for our iniquities; the punishment that brought us peace was upon him, and by his wounds we are healed" (Isaiah 53:3–4). Isaiah's starkly relational language, indicating that the sacrificial victim's goodness and claim to innocence is imputed to repentant sinners, prefigures, and perhaps prompted, Levinas's belief that "responsibility for the Other . . . is more ancient than any sin."[40] It is more ancient because the sacrificial assumption of responsibility for the other, for all that seems to lie outside oneself, calls the world into existence: a world now marked by sin but whose provenance is pure and original goodness born of selfless, sacrificial love.

Christians see Christ as "the Lamb slain from the creation of the world" (Revelation 13:8). This suggests a pre-cosmic event or promissory offering, a sacrifice older than or ontologically prior to historical time. Indeed, intimations of Christ's pre-cosmic being are found all throughout the New Testament, a fact underscored by Simon Gathercole, H. C. Kammler, and others.[41] Kammler wrote that "the pre-existence of Christ in Paul . . . is conceived of as *absolute, real,* and *personal.*"[42]

One of Paul's portrayals of Christ indicates a selfless but harrowing descent into mortality from a pre-existent state of glory or "equality"

It is an antecedence prior to all representable antecedence: immemorial. The Good is before being" (*Otherwise than Being,* 122). Original emphasis.

40. Emmanuel Levinas, *Difficult Freedom: Essays on Judaism,* translated by Seán Hand (London: Athlone Press, 1990), 225.

41. Simon J. Gathercole, *The Pre-existent Son: Recovering the Christologies of Matthew, Mark, and Luke* (Grand Rapids, Mich.: Wm. B. Eerdmanns Publishing Co., 2006); H. C. Kammler, *Die Präexistzaussagen im Neuen Testament* (Frankfurt am Main: Lang, 1990); Terryl L. Givens, *When Souls Had Wings: Pre-Mortal Existence in Western Thought* (New York: Oxford University Press, 2010); Brendan Byrne, "Christ's Pre-Existence in Pauline Soteriology," *Journal of Theological Studies* 58, no. 2 (1997): 308–30.

42. Cited in Gathercole, *Pre-existent Son,* 31. Original emphasis.

with God. "[T]hough he was in the form of God," Paul writes, he "did not reckon equality with God as a thing to be exploited, but emptied himself, taking the form of a slave, being born in human likeness. And being found in human form, he humbled himself and became obedient to the point of death—even death on a cross" (Philippians 2:6–8). Pre-cosmic equality with God makes sense only if Christ were, as Gathercole puts it, "the heavenly-yet-crucified Son."[43] That is, if he had, in some way, already been slain as a sacrificial lamb, already allowed himself to be delivered up for the sins of a world not yet created. In his intercessory prayer, offered shortly before his betrayal and crucifixion, Jesus said: "And now, Father, glorify me in your presence with the glory which I had with you before the world began" (John 17:5). His passion was about to begin on earth, and though it would unfold as a sequence of historical events, its reality transcends human history. Upon overflowing the separating categories of time and space by which our understanding of the world is routinely parsed, it enables our salvation from the limitations of those categories.

Christ's pre-existent glory is not just alluded to in scripture but also described. In the book of Revelation, John sees "a Lamb, looking as if it had been slain," standing before God's throne. When the Lamb takes a sealed scroll from God—a feat no one else could accomplish—those around the throne fall down to worship him. John writes that "they sang a new song: You are worthy to take the scroll, and to open its seals, because you were slain, and with your blood you purchased men for God." John further records that amidst this chorus he "heard the voice of many angels, numbering thousands upon thousands, and ten thousand times ten thousand," all uniting in joyous adoration of the Lamb and according him "praise and honor and glory and power, for ever and ever" (Revelation 5:6–13).

43. Gathercole, *Pre-existent Son,* 297.

To be sure, this passage may be understood as describing a future, post-mortal event, but the context anticipates events that will unfold on the earth. The scroll, after all, is routinely seen to contain "the secret purposes of God about to be revealed"[44] amid the earthly tribulations of the faithful. The new song spontaneously erupts when it is realized that God not only foreknows the calamities that will befall the faithful; more importantly, he has providentially supplied a sacrificial lamb to redeem his followers from the perils of mortality.

But the question of when the song is sung is really irrelevant: the song itself marks an event that elicits our worship "for ever and ever," implying that the slaying of the Lamb transcends human history. If it were not transcendent, the song would die; the rapture of the moment, that is, would die, and reality would cease to be exclamatory. In Levinas's language, stasis or self-same being would settle in. This, however, does not comport with everyday experience. Granted, we experience the dispiriting effects of aging and entropy, but we also, at every moment, experience time's redemptive cut toward never-before-seen newness. The passion of Christ, I propose, is hidden up in this tiny redemptive cut, the newness of the present moment.

In reminding Job of his limited understanding, God asked: "Where were you when I laid the earth's foundation . . . while the morning stars sang together and all the angels shouted for joy?" (Job 38:4–7). The creation of the cosmos was not merely the result of deliberative thought; the spontaneous shout of joy marked Christ's pre-existent assumption of sacrificial responsibility for the cosmos. That shout, writes Hugh Nibley, is "the Morning-song of Creation, which remains to this day the archetype of hymns, the great *acclamatio,* the primordial nucleus of all

44. "Revelation 5," *Matthew Henry's Concise Commentary on the Bible*, http://www.biblegateway.com/resources/commentaries/Matthew-Henry/Rev/Another-Angel-Casts-Fire-Earth.

liturgy."[45] It celebrates the moment of substitution whereby, to follow Paul, Christ, though enjoying equality with God, "emptied himself" of self by offering himself for others. And because the offering was freely and utterly given, it transcends condition and limitation. Without thought of reciprocity, of *quid pro quo,* the substitution was performed, and therein resides its transcendent saving power. The efficacy of the expiation is endless in virtue of its utter passivity or vulnerability, as Levinas puts it, or, as Paul proposes, in virtue of its kenotic self-emptiness which knows no bottom and therefore no limitation or exhaustion. Uncircumscribed by self-interest, Christ's passion ushers in creation, which is nothing less than a sphere of otherness inviting us to share in the fellowship of his sacrificial love.

Reality is thus graced by otherness, by the for-the-other expiation of Jesus Christ. But since the expiation burns away the memory of its own goodness, its presence is self-forgotten. What, therefore, we might expect to witness as cosmic spectacle and the cynosure of all eyes, a commemorative occasion of universal praise and adoration—this, in fact, barely registers and then only fleetingly so as the expiation, unmindful of its own goodness, re-enflames the world with new meaning as if *this* were the moment of creation. I submit that we glimpse the fleeting, trace-like, for-the-other presence of Christ's passion in the fleeting, trace-like, for-the-other reality of entangled particles. Their entanglement bespeaks innocence of self-centered being because they are not determinately self-centered; they simply lack the requisite properties. And given this lack, which is nothing less than an inability to secure themselves as independent objects, they also lack the ontological wherewithal to shield themselves from each other. Entangled particles, Levinas might say, are

45. Hugh Nibley, "Treasures in the Heavens," in *Old Testament and Related Studies,* The Collected Works of Hugh Nibley, vol. 1 (Salt Lake City: Deseret Book, 1986), 173. Nibley adds in an endnote: "This is an unfailing part of the picture: the Hallelujah chorus with its refrain of 'Forever and ever!' is the closing section of almost any ritual text" (191).

fully vulnerable to each other, having no protective ontological façade, and so they exist unitarily, each losing itself in the other and ultimately, I suggest, in the expiatory birth of the cosmos. Hence, they do not exist as distinct objects but rather as occasions exclaiming the goodness and pain—the passion—of that birth.

I offer this as a Christian perspective on quantum entanglement. It is a "likely story" or plausible scenario that builds on Shimony's passion-at-a-distance interpretation of quantum entanglement. Metaphor is a fault line that runs through scientific explanation, and the need to invoke subjective terms like *passion* and *feeling* to explain particle behavior suggests a story deeper than the one which mechanistic metaphysics affords. To be sure, we have gotten tremendous mileage out of that metaphysics, but as Alfred North Whitehead pointed out, "The narrow efficiency of the [mechanistic] scheme was the very cause of its supreme methodological success." When, however, "we pass beyond the abstraction, either by more subtle employment of our senses, or by the request for meanings and for coherence of thoughts, the scheme breaks down at once."[46] In the wake of that breakdown, I offer a Christian reading of quantum entanglement.

46. Whitehead, *Science and the Modern World,* 17.