Polarization

1. Introduction

The Impressionist Theory of Everything (IToE) broadly studies the relationship between elements that define a common space but are paradoxical for their properties. This is a Russell set construction (*R*) that is also herein referred to as a *not-set*. In physics, the not-set is the identifying feature for the problem presented by wave/particle duality in EPR-type phenomena. There are numerous interpretations for the attendant paradoxes that result from the dualism of observational perspectives between local and non-local co-related structures. It is generally accepted that the quantum picture of the universe is the correct one, and the classical picture is somehow wrong although the reason for this has never been clearly established. The classical picture is judged to be invalid based on the fact that it failed its own test in the criteria of Bell's Theorem and quantum mechanics has been so successful.

The Impressionist Theory of Everything contains a different interpretation. It is claimed that classical and quantum-based co-spaces contain two distinct dimensional frames of reference that are necessarily paradoxical for their properties across the dimensional boundary that separates them. Where all other interpretations inherently infer that paradox is an anomaly, IToE takes the interpretation that paradox is a natural mechanism in the construction of quantum/classical co-spaces, and that a single theoretic principle is not discoverable.

The mechanism and defining characteristic of all paradoxical constructions is that some appropriate relationship of parts has been reversed, and this creates a not-set configuration across two forms of property for the same space. The result is that two fundamental descriptions exist for the same common frame of reference for property but they are not members of themselves. A critical factor in the transformation across such correlated parts, and which is found in all EPR structures, is that the amount of information contained across them must be consistent. The boundary between these descriptions will be shown to be dimensional.

This paper examines how the amount of information is conserved across dimensional boundaries as described above for wave/particle duality found in the phenomenon of polarization. References to the half-silvered mirror and two-slit experiments are interspersed to give a perspective on how all EPR experiments display the same general principle.

The dualism of paradoxical perspectives in all EPR phenomena is based on the difference between two distinct dimensional platforms - one sub-classical or quantum-mechanical and the other classical. Experimental devices used to study the EPR phenomena of photons allow the observer to select, at will, between two dimensional frames of reference for both for individual photons and a photon ensembles. In each experiment, a mechanism is applied that transforms the property of the photon between wave and particle or single path structure. In all cases, an instantaneous collapse occurs across the dimensional boundary that separates the entangled sub-classical state from the non-entangled, classical state for the same structure.

At the sub-classical level there are, as a minimum, two half-phases to the waveform, and in the process of collapse one of these half-phases is subsumed and hidden, while the other is emergent. The half of the cycle that the observer 'is in' when the collapse is initiated determines which half-phase is emergent. This is a process of inflation to the classical level. It is important to emphasize that this is a process of inflation across a dimensional boundary , not the simply the combining two parts to form a whole as would be the case if the there was a consistent dimensional framework.

There are two methods for forming the dualism of concatenated states as described above. The first method is to open a classically fundamental state to its sub-classical parts. The second is to link, as sub-classical, more that one fundamental particle in the classical domain. In both cases a not-set construction is formed.. It will be seen that whether or not the sub-classical space so created is robust, depends on which of these two forms applies.

If a single fundamental particle, at the classical level, has been opened, then the concatenated space will not be robust for its parts when it is interfered with. By contrast, if the fundamental space is created from more than one classical-level particle then the construction will be more robust and need not necessarily collapse. It is particularly instructive to understand that, for Bell's Theorem, we should not expect the parts of a concatenated structure to display informational independence. These parts share the same information state even thought they also display classical separation in space and time. In effect, two dimensional frameworks have been layered on each other.

For this layering, the first part is that two photons have membership as classically discrete particles, at the classical level, and the second part is that they have been concatenated with quantum linkage as singular to the classical observer. There is a natural conflict between two such layers of dimensional structure - one local an the other non-local. However, there is no conflict for the amount of information contained between them. It is the same. This dualistic sub-classical closure of particles across a classical space is created by the experimental device use in each experiment on the polarization of the photon.

EPR-type experiments allow us to easily explore the generic structure of the not-set and how it represents the precursor to emergence of the more dimensionally-complex classical version of the same space. The observer is able to shift back and forth across two formats of the respective spaces. For two classical parts concatenated quantum-mechanically, these parts are not members of themselves yet they are members of the same state. This is the defining feature of the not-set.

In contrast to the stationary structures studied in EPR experiments, dynamic structures also exist in which a not-set generates its own dimensional complexity and shape through the outward development from a null state. In this case, no stopping of the process of accumulation is possible. Examples are the flow of time and gravitational force. The self-generation of cycle and the shape that results is described in a separate paper, Chapter 1.5, The Cross-Dimensional Development of Angularity. In a dynamic context, the not-set *R* takes on physicality as a 'pressure'. The pressure of *R* applies to each location in the universe as well as the universe itself.

The Impressionist Theory of Everything is a limited dimensional model that traces the development of the above format of complexity across the boundary between sub-classical and classical space in a two-dimensional framework. Dimensional development extends beyond just the two dimensions of this model to infinity, but is not appropriate for inclusion in the model. Nevertheless, an interpretive framework is established.

For the phenomenon of polarization the following topics will be discussed.

1. Simple polarization and its application in a two-polarizer experiment.
2. The three-polarizer paradox.
3. The paired- or parallel-polarization-state experiment, which leads to the discussion of Bell's Theorem.

2. Simple polarization and its application in the two-polarizer experiment.

The 'architecture' of sub-classical space is unique in each EPR experiment. It may appear as the selection between just two degrees of freedom, for example in the half-silvered mirror experiment, or as the continuous spectrum of the wave interference pattern, as in the two-slit experiment and the parallel-polarization-state experiment that demonstrates and Bell's Theorem.

The term *de-selection* denotes any operation in which the selection of parts at the classical level is nullified. One part has been hidden from classical selection. Each example of the transformation is unique but the effect is the same. The amount of information contained is conserved between two different dimensional constructions of the same space. There is no better example of this than as found in simple polarization.

The photon is a classically fundamental particle here referred to as a *singularism*. In the most general sense it is a fundamental piece of *information*. This singularism displays two contexts of structure as either a waveform or a particle, and in this, the nature of not-set construction for a common space. Even though the photon represents a fundamental piece of information in classical space, that does not restrict reformation of this singularism as a dualism. However, what is restricted, for this, is that the newly formed dualism must not contain more information to the observer than first represented. Of note, the exception to this is that if the process is dynamic, then the amount of information that is real in the space increases. The resource or "well" for this dynamic increase is the infinite potential of imaginary space.

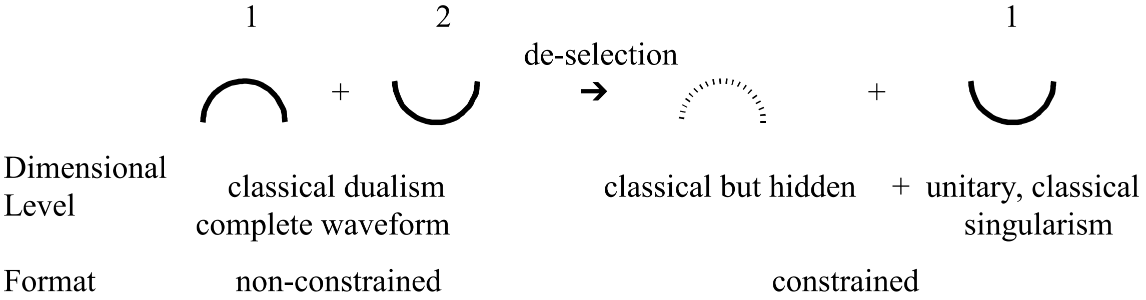
When polarization is induced by passing an nonpolarized light beam through a polarizer it raises the sub-classical architecture of a singularism (namely the waveform, and equally a particle having single path) to a space in which there is a distinction between two orthogonal directions. In other words, where there was only one piece of information, the polarizer has created the potential for two pieces of information. A two-value dynamic attribute has been induced or opened that was previously hidden as a waveform or equally as a particle that did not display alternative between orthogonal directions.

In any instance that a fundamental object, at the classical level, is forced to respond within a system that contains more potential, the only way its "fundamentality" can be conserved is if the excess potential is, in some manner, hidden. In the case of simple polarization, what has been opened is the potential for the display of two orthogonal directions in space where there should be only one. The result is that one of those directions must be hidden.

Accordingly we find that the polarizer has the ability to select one orthogonal direction for transmission (along its axis), and hide the other direction. The second effect of this is that because the nonpolarized beam has an equal mix of photons with potential for polarizations in two directions, only one-half of the photons will be transmitted while the other half is absorbed.

Classical space contains more potential for what is "real" because its dimensional framework is more developed. Through polarization, the sub-classical structure of the photon that has been opened in a higher dimensional framework, instantaneously collapses to one of the two values for the new level of potential.

(a) de-selection at the classical level



(b) opening the sub-classical parts of the de-selected constrained state from (a)

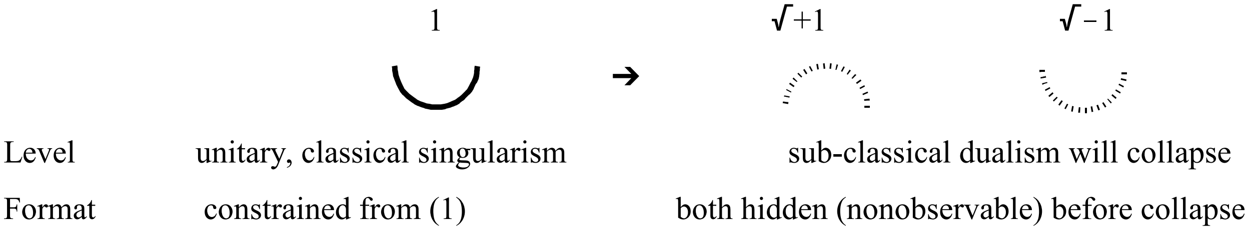


Figure 1. In (a) the full potential for orthogonal direction here shown schematically as two halves on the left are constrained as a singularism by de-selection of one-half of the state. Examples are the incident direction of in the half-silvered mirror exp. and the vertical axis that is transmitted for polarization phenomena. In (b) the sub-classical architecture of a classical singularism is schematically represented. On the right side are two sub-classical half-phases. For classical display one part must be subsumed while the other then inflates.

Although the selection of alternatives appears to be classically determined (as in the flip of a coin), the collapse is fundamentally based on quantum criteria of weighting. The process of collapse for each photon, to one of the orthogonal directions, is an inflationary action. One of the half-phases becomes emergent and the other is subsumed. This is schematically represented in Fig.1. The result (which is also the point at which observation occurs) is that only one-half of the photons emerge from the polarizer.

The polarizer serves as a 'gate' that opens the sub-classical wave-form architecture of the photon as a dualism that must also instantaneously collapse to just one of two values in order to conserve the amount of information that the single photon naturally represents. Which half-phase of the sub-classical architecture that emerges in the case of each photon is randomly determined by the exact timing as it crosses the polarizer relative to the cycle of its emergent and subsumed phase components. The half-phases are entangled before they are dimensionally raised to the classical level and either transmitted or absorbed.

Restating the above, the fundamentality of the photon as a singularism must be conserved, and since this fundamentality has been violated by the classical dimensionality of the polarizer, the photon is forced to collapse across the two possible induced values of the attribute. First there is an inducement of a sub-classical architecture and, in the same event, a filtering of it on one axis. In this case, the opening and closing actions are instantaneous.

A de-selection of one of the values across the two-value state of the classical space has occurred. For the newly filtered beam of photons (polarized), this selected direction of polarization is now the singularism to which all further experimentation applies. A polarization state of just one direction (not two orthogonal directions) now forms a new context of 'singularism' at the classical level.

To illustrate how different frames of reference apply in different experiments we can jump ahead in the discussion and compare simple polarization to the paired polarization state that is the subject of Bell's Theorem. For paired polarization, the singularism created by the experimental apparatus is the entanglement of two photons. Thus, in both the cases, a generic singularism contains hidden dualism. The distinction in the case of paired polarization is that this singularism refers to the correlated values of two classical-level photons. The classical dualism that each photon should have its own discrete polarization is hidden. The actual value that they share, on observation, is incidental. The important thing is that their polarizations are paired as singular at the classical level and consequently must display a quantum signature. By contrast, the hidden dualism of simple polarization is that transmission on one-half of the potential orthogonal axis is hidden.

3. The two-polarizer experiment

In the two-polarizer experiment a beam of nonpolarized photons is sent through a polarizer that produces a *V*-polarized beam. Only vertically polarized photons are transmitted, and there is no component of *H*-polarization in the beam. A second polarizer is then placed in the polarized beam and results are recorded as the second polarizer is rotate from 0 to 90 degrees. The second polarizer has forced the opening of a sub-classical which is the superposed directions of polarization at 45 degrees, (D) $\oplus$ (S) for *diagonal* and *slant*.(lower dimensional).

This sub-classical space is now the determinant of whether or not photons in the beam are transmitted or blocked. As the relative angle of the second polarizer is increased the sub-classical probability weighting for the two half-phases (D) $\oplus$ (S) changes. The weighting is a nonlocal (entangled) relationship at polarizer (2). As for the first polarizer, classical influence and collapse is instantaneously when the photon crosses the boundary of polarizer (2). What was a singular state displaying only the attribute *V*-polarization before polarizer (2), collapses to a single value of the two-attribute orthogonal structure of polarizer (2).

Whether or not each photon is transmitted depends on two factors. The first relates to the sub-classical cycle of the two half-phases (D) $\oplus$ (S). Relative to the observer this cycle can be in the emergent or subsumed portion as it crosses the polarizer. If the half-cycle is in the subsumed half-phase portion, then the photon will collapse to the state of non-transmission which the direction *V*.

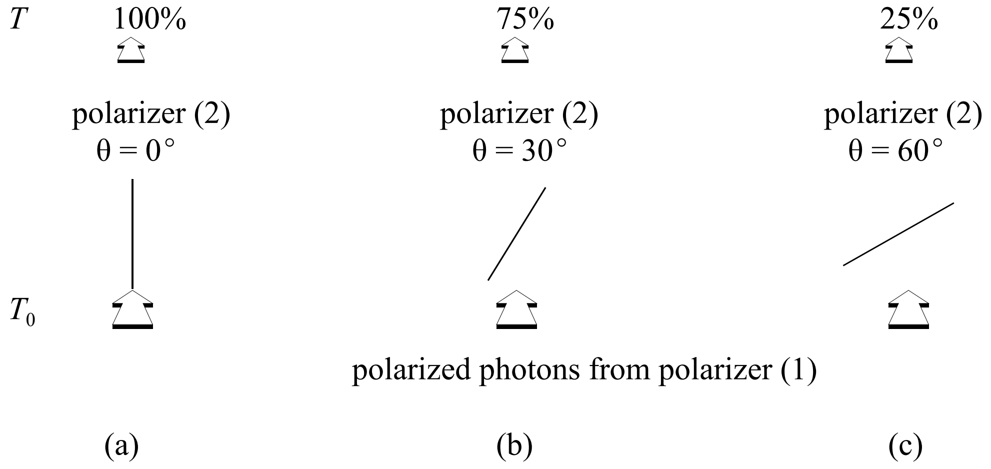


Figure 3. A polarizer (not shown), has created a V-polarized beam. (V) = (D) ⊕ (S). These photons are directed through a second polarizer called polarizer (2) which is shown in 3 different angles of rotation. In any event that the superposed state (D) ⊕ (S) is observed it must collapse to some classical value. The state that results is a combination of the weighting by rotation and the random factor of timing of the sub-classical collapse fo the two half-phases. For transmission (*T*), $T = T_0 \cos^2 \theta$.

The second factor is the amount of rotation of the second polarizer. This rotation induces its own weighting between the two half-phases. As the angle of rotation approaches 90 degrees the observer is permanently flipping the sequencing toward the half-phase of complex (D) ⊕ (S) that produces non-transmission as *H*. As polarizer (2) approaches $\theta = 90°$ the observer is undergoing orientation-reversal relative to the half-phases (D) and (S). At 90 degrees, all photons emerging from polarizer (2) will now inflate to the half-phase that is subsumed rather than the half-phase that is emergent and no photons will not be observed.

3.1. Multilayered EPR effects in the two-polarizer experiment

The phenomenon of polarization presents a multilayered view of the process of opening a sub-classical space to the classical observer. For the classical observer the photon is a singularism. The waveform description satisfies this because no location or direction can be assigned to the photon in the first place, and the particle view satisfies it because the particle displays only singular path. When a more complex, higher dimension of orthogonality is introduced across a polarizer, the classical view of the photon as a singularism is saved because, transmission in the second orthogonal direction is hidden (non-transmitted) to the classical observer. This effect is then duplicated when the photon crosses the second polarizer.

3.2. A note of distributive and nondistributive logic

The logic of classical structure is a distributive framework of alternatives. In other words, every member of the state bears some rational relationship to every other member. This is not the case in a quantum-based space. In this case the members of the state have locational relationship that incorporates sub-classical complexity. Dimensional boundaries exist between the parts, and a nondistributive logic applies.

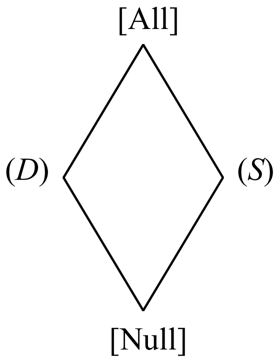


Figure 4. The nondistributive relationship of the two-polarizer structure is illustrated.

In the two-polarizer experiment, under the quantum description, the two classical observables are represented in the basis (*V*) and (*H*) are respectively the [All] and [Null] condition. By contrast, the parts of the basis (*D*) and (*S*) do not bear relationship to each other in a classical space. Rather they are sub-classical. These directions display relationship only to the states [All] and [Null]. The [All] condition is that a photon is recorded. The [Null] condition is that a photon is not recorded. As can be seen in Fig. 4 (*D*) and (*S*) have relationship only through [All] and [Null]. A full discussion of the nature of distributive and nondistributive structures can be found in the book Quantum Reality.[1]

4. Three-polarizer paradox

In the three-polarizer paradox, a nonpolarized beam of photons is passed through polarizer P(1). As discussed above, the beam has then been cut by one-half since, on average, one-half of the photons in the nonpolarized beam will have collapsed to the half-phase that is subsumed rather than transmitted on the horizontal axis. The direction (*V*), which is transmitted through polarizer (1), is defined quantum mechanically as a superposition of the diagonal (*D*) and slant (*S*) directions at +45 and −45 degrees to (*V*). Of note, this mimics the classical probability that one-half of the photons had (*V*) polarizations and one-half had (*H*) polarizations before polarizer (1), but that is not the case. Rather the (*V*) and (*H*) polarizations were always entangled. Only at the polarizer were real polarizations induced on each photon.

A polarizer, P(2) is placed in the beam that is now polarized. Its optical axis is rotated 90 degrees to the first polarizer. This is the same arrangement as in the two-polarizer paradox. The photon beam is now completely blocked. This is the null condition of the classical singularism represented by the fundamental structure of each photon in the beam.

A third polarizer (P3) is now placed between the first two. The effect is that when (P3) is rotated to $\theta = 45^\circ$ some photons are allowed to pass through the last polarizer (P3) when they were previously blocked entirely. The notions of how photons are blocked in classical terms does

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[1] Herbert, 1985: p.179

not explain this phenomenon. Regardless of the middle polarizer and its own rotation to the beam, all photons should still be blocked at the end of the last polarizer.

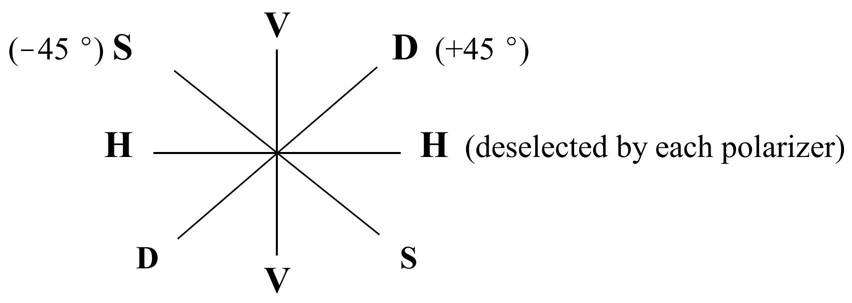


Figure 5. The vertical / horizontal structure (*H*) and (*V*) is shown as well as second space of property formed in the diagonal to slant directions, (*D*) and (*S*). When the second polarizer is rotated away from θ = 0° toward θ = 90° interference becomes a factor in the transmission of the photon beam. This space cannot be described classically because it is a sub-classical opening of complexity.

$$(H \oplus V) \oplus (H \oplus \mathrm{V}) = \mathrm{H} \tag{4.1}$$

↑ ↑

Interfere destructively

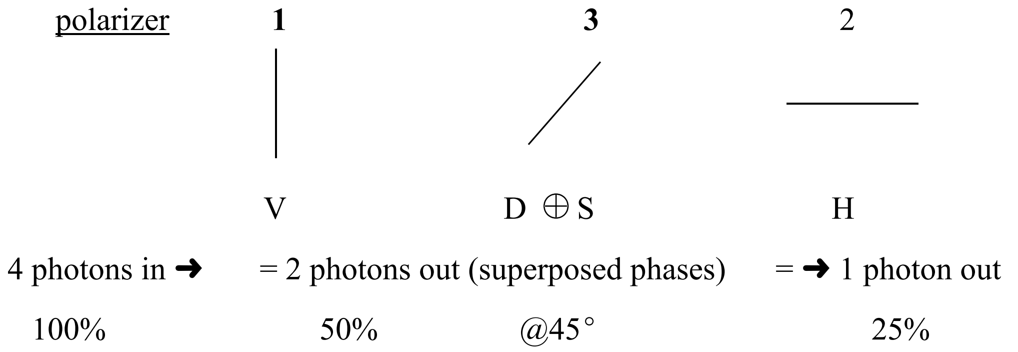


Figure 6. The angles of the three polarizers are illustrated as each one appears to the photon beam. The middle polarizer (3) is rotated between 0 and 90 degrees. When θ = 45°, the superposed phases are equally weighted. Statistically, when P(3) is at 45°, 4 incident photons produce 1 photon after the third polarizer.

Rather, it is now found that some photon will pass. The critical issue is not the relationship of the first and last polarizer but rather the sequence of polarizers to the beam. Because the rotation of each subsequent polarizer is 45° to the one before, there is an equal weighting of the sub-classical half-phases of each photon as it is forced to display sub-classical structure when it passes through the next polarizer. The result is that the original beam has been cut by one-half twice, and one-quarter of the photons are transmitted from the last polarizer.

Thus, the beam that could not be transmitted when there were only two polarizers can now be partially transmitted. The important point is that each polarizer opens a sub-classical structure to the observer. The collapse of the beam to one-half its previous intensity conserves the singularism of the classical structure of the photon at the level of each polarizer.

4.1 The Key element in the Impressionist interpretation

As in the two-polarizer experiment and for that matter all EPR structures, the three-polarizer experiment demonstrates that at each stage a classical singularism is forced to open as a less fundamental construction of more possible states. It is less fundamental because the photon does not allow orthogonal states that are real; however, the space that is induced by the polarizer does contain this distinction. What should be a singularism of real possible states is forced to display a dualism. The consequence is that, in some manner the newly created and larger degree of freedom must be hidden to the classical observer. The important point is that the photon has entered a space that contains more potential. Each path contains information about the photon in classical terms. Consequently, one path (H) is prohibited from displaying information and it collapses as a null condition. This conserves the simpler information state of the photon. This mimics the situation that the photon has chosen one of two paths but in actually is a completely different process. The second path, on which the photon is not found is a not a member of the state of the photon.

The photon has a simpler dimensionality that is across 180 degrees not 90, and the orthogonal direction at 90 degrees, which is the defining angularity between real directions in classical space, is instead imaginary. The relationship of these distinct dimensional levels cannot be interpreted without the introduction of paradox as a mechanism.

5. The parallel-polarization-state experiment and Bell's Theorem

In this experiment, a central source emits pairs of photons [(*A*) and (*B*) in Fig. 5] at 180 degrees that are polarized in a twin state. Interpretation of this experiment, under Bell's Theorem, is that it proves the classical description of the universe is flawed. This conclusion is based on the fact that classical particles having separation in space and time but display quantum characteristics, not classical. Under IToE this conclusion is not a justified. Rather, the evidence points to the fact that there are two different dimensional frameworks superposed on each other - one quantum and the other classical. The separator and mechanism between these frameworks is paradox.

The justification of this new interpretation is first understood as a principle of conservation for the amount of information contained in the quantum and classical sides of EPR experiments in general. The parallel-polarization-state experiment is the first EPR structure to demonstrate that this principle applies not only to the structures of fundamental particles opened to their sub-classical space, but also to more than one classical particle concatenated as "one" in classical space.

Specifically for Bell's Theorem, when two photons are linked as a single state, the observer must not be able to distinguish between them. This conserves the amount of information that should be found in the eye of the observer. If the two photons emitted from the source were not linked as a single state then, indeed, we would find that their states obeyed classical probabilities. The mechanics of this principle of conservation is that we find two distinct dimensional frameworks superposed on each other. An important difference between this and other experiments is that the entanglement of the states is robust, and that is to be expected. This experiment does not open a sub-classical space of a single particle. In that case observation of the relationship of any two parts would necessarily cause their collapse under the same principle of conservation. For parallel-polarization, if the sub-classical correlation was not robust, then the newly created singular state would violate the amount of information that should be contained in the classical domain which is one piece not two.

The apparatus of the above experiment employs two calcite crystals to measure the polarization-property of each photon in the concatenated pair. Calcite has an optical axis that sends the photon in two different directions depending on the state of polarization for the photon. If the crystals have the same orientation in space then the polarization state observed for each photon is always the same (both are either up or down). If the crystals have some relative rotation across their axes, then errors are created between the values. These errors are found to not be statistically based on local factors acting independently. Rather, they are linked as quantum probabilities. Quantum formalism applies rather than classical probability.

Bell's proof is based on the first assumption that the error rates between the polarizations recorded for both photons must be determined by local factors at each measurement site since these are classically distinct locations of separate particles. When the error rates were both predicted and, later, experimentally found to be higher than possible based on local factors, Bell's inequality was violated.(see Figure 5). The result was that there is a fundamental discrepancy between classical theory and what is actually observed.

The detail of the proof is as follows. In the example below, crystal (A) is first rotated by 30 degrees, and crystal (B) is not rotated. Crystal (A) is said to have a polarization attribute of $P(30)$. The disagreement between the crystals is found empirically to be 1/4. This is predicted by the equation $P(\theta) = \cos^2 \theta$. Similarly, when crystal (B) is rotated by -30° and crystal (A) is not rotated, the disagreement between the crystals is again 1/4, as expected.

The problem for the classical description appears when both crystals are rotated. In classical terms, the error rate is based on the random difference that each site contributes, which is an error rate of 1/4. In classical terms, the error rate contributed by both sites is 1/4 + 1/4 = 1/2. The classical error rate between the two sites must also include the possibility that, on some occasions, the sites will randomly have the same error. Thus, the final statistical error rate will be 1/4 + 1/4 − (the chance factor of agreement). The error rate across the sites calculated from the combination of the two sites, which each contribute a factor of random error, should be < 1/2.

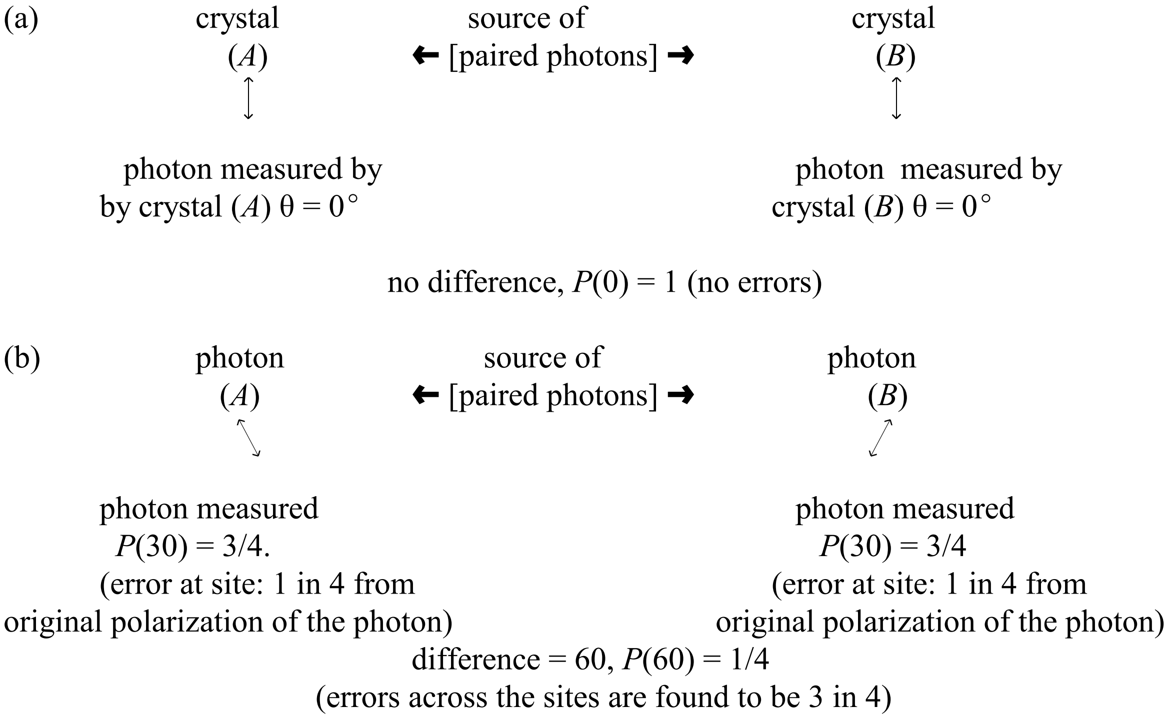


Figure 7. The parallel-polarization-state experiment. In (a) the crystals have the same angle and the error rate is zero. When either crystal is rotated 30 degrees, the error rate between the sites is 1 in 4. Thus, each site independently should contribute an error rate of 1/4. When both sites are rotated 30 degrees, the error rate should be less than 2 in 4 but instead is 3 in 4. The correlation for errors between the sites is too high to be determined by addition of classically independent error rates.

However when the empirical results are analysed, the error rate is found to be 3/4, which is considerably greater than classically predicted. This error rate is predicted by the trigonometric function $P(60) = \cos^2 (60) = 3/4$, and not by a simple random relationship of independent error rates at two classically separated sites. The rate of error across the sites is too great to be explained by a classical interpretation of randomness. Rather, the error rate is only allowed if the sites act nonlocally as a closed, unitary, quantum-mechanical structure.

5.1. An analogy to Bell's Theorem

Individual outcomes are called events. The outcome of each event is registered simultaneously at two locations by separate observers, (A) and (B). The same outcome is centrally predetermined for each event so that there will be no disagreement on the outcome. Note: under quantum theory, the two possible outcomes for each event are entangled until recorded by one of the observers at which point they collapse to the same value.

Rotation		Randomness for one observer with the centrally established value	
		quantum-like	classical-like (as if turning down a tap)
0	=	no disagreement	no disagreement
22.5	=	---	1/4
30	=	1/4	---
45	=	1/2	1/2
60	=	3/4	---
67.5	=	---	3/4
90	=	completely random	completely random

Chart 1. Randomness to a centrally controlled two-value result under quantum criteria and classical criteria (as if controlled by a valve over 90 degrees).

Each observer controls a mechanism to interfere with this centrally controlled agreement. Specifically each observer controls a dial that rotates across 90 degrees. At zero degrees, there is no disagreement with the central mechanism of agreement. At 90 degrees the central mechanism of agreement is nullified and outcomes at that site will have no connection to it. Agreement/disagreement is completely random.

Two angles of rotation are critical to the argument. Values for the rate of disagreement between quantum-like and classical-like criteria are shown in Chart 1. Only the critical values of disagreement are shown. The dial of disagreement for observer (A) is rotated 30 degrees. From well-established theory and previous experiments on polarization the result is well-known. The disagreement between the predetermined centrally controlled outcome and the outcome at (A) is 1/4 over multiple events. From the chart it is seen that the criteria which determines disagreement at that site is not based on a physical effect similar to turning down a valve. Over four events disagreement for (A), to the centrally controlled result as well as (B) will be [1/4 - (the chance that they may agree by accident)]

Now dial at (B) is also rotated 30 degrees. The error rate at that site is now found to be 1/4 to the centrally controlled result. The rate of disagreement is now controlled by (B) as well as (A). If the actions at (A) and (B) are independently determined then the rate of disagreement between them is: [1/4+1/4 - (the chance that they may agree by accident)]. Consequently, if the events at each site are based on random disagreements under classical criteria, they will disagree by some amount less than 1/2.

This is not what is found. The rate of disagreement is 3/4. This is the same as the disagreement rate if a single observer rotates the dial by 60 degrees under quantum criteria. Thus the result is the same as if there is only one observer. The two observers do not determine outcome independently even though they have independent classical separation in space and time. The two observers are not operating independently under classical rules of probability. The only conclusion is that classical probability does not apply and the structure has quantum-mechanical linkage.

5.2. The significance of Bell’s inequality

Bell’s inequality has a special status in discussion of the relationship between classical and quantum mechanical structure as represented in EPR-type phenomena. The conclusion drawn is that, even though the experiment is classically based, classical statistics cannot be applied to it. For the first time, facts established statistically in the classical description were used to prove that the classical description fails under its own terms of reference. Thus, the quantum-mechanical description must be fundamental and the classical description non-fundamental.

5.3. Bell's Theorem and the Impressionist Theory of Everything (IToE)

The Impressionist Theory of Everything (IToE) describes the cross-dimensional relationship between structures that display both fundamental singularism and dualism for a common space. The two sides for this in EPR experiments are that one description is quantum-based and nonlocal and the other is classically based and, local. This is paradoxical to our rational bias that real and final singular conclusions must be possible. We have a deeply embedded confusion over how fundamentality is established that is based in belief and not science. Science tells us that there is no such thing as absolute and singular final conclusion.

In EPR-type experiments there are two general formats for constructing the singularism/dualism dichotomy of separate descriptions of a common space.

1) A fundamental structure at the classical level is opened to its internal parts. These parts have a non-local signature or,

2) More than one classical state is concatenated as a non-local entity.

The parallel-polarization-state experiment and its associated Bell's Theorem fall into the second category. When entangled photons are observed at classically separate locations, their polarization states are entangled and remain so. Although the polarization observed for each photon collapses to some random value, the relationship of the photons, as entangled, does not change. The reason that the entangled relationship between photons does not collapse into classical randomness, as is the case of the sub-classical state of single particles in other EPR experiments, is that the parts of this dualistic state (that create this structure of superposition) are classical. We should not expect the relationship of paired photons to collapse into independent states when measured at the classical level. Consequently the quantum relationship between them is robust.

The orthogonal signature of sub-classical structure is easily identified in this experiment. The photons are emitted from a common source at 180 degrees to each other. They have been down-converted to a simpler relationship of dimensionality that is quantum-mechanical not classical. The direction in space at 90 degrees is imaginary to their concatenated relationship.

5.4. Path structure in the half-silvered mirror experiment and the parallel-polarization-state experiment

The parallel-polarization-state experiment and the half-silvered mirror experiment share the same characteristic: a single observable of property in each experiment is classically created as a concatenation of two quantum-mechanical parts.

The difference between the constructions is that, in the half-silvered mirror experiment, one photon is split to form an entangled pairing at the sub-classical level on separate classical paths, and in the parallel-polarization-state experiment, two photons are linked to form an entangled pairing on separate classical paths. The error in interpreting the results in either experiment is to assume that the relationship of paths is classical. They are not. Rather the apparatus has fundamentally changed the orthogonal structure of the space of that the paths, as properties of the particles, represent. A quantum-mechanically linkage is found in each instance.

The paradoxical situation for the classical description in both cases is that the observables of properties (displaced in space-time) should have a random relationship when they do not. In both occurrences, properties are linked nonrandomly since their state is instantaneously communicated regardless of the distance that applies. The limit of communication, for classical causality, which is established by the speed of light, is therefore violated.

Under IToE, this violation must occur in order to conserve the potential of the structure across two dimensional levels (sub-classical and classical). Sub-classical sites are dimensionally less complex than classical sites and accordingly they are inherently not observable.

6. The trigonometric architecture of hexorthogonal geometry at the sub-classical level

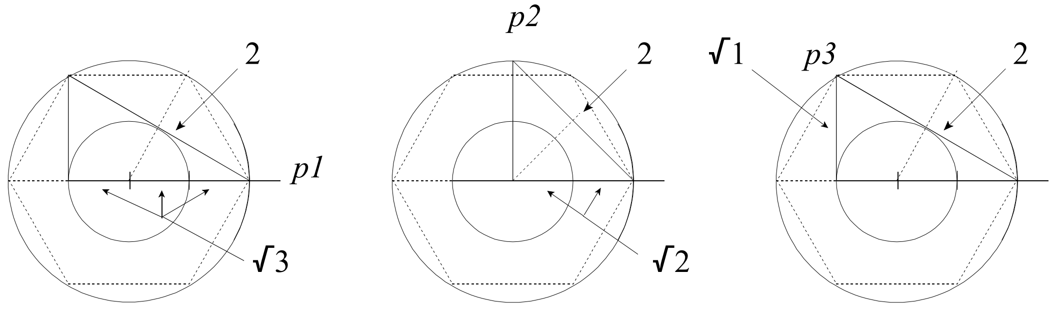
There are two non-classical and one classical geometries described for the unit circle under IToE (see 1.4 Two Geometric Spaces, One Roof: The Local and Nonlocal Structures of the Unit Circle). Two of these structures are sub-classical. The first is the Wessel-Argand-Gauss plane. The second is based on a process of outward development that produces an eccentric hexorthogonal structure having two formats of origin and a central null domain.

Key trigonometric functions can be recognized by the projection of points found on the circumference of the hexorthogonal format. The relationship of the position for these points under rotation, and their linear projection around the structure, demonstrate the reason (from a cross-dimensional perspective) that $\cos^2 \theta$ is the basis of transformation between rotationally closed (quantum mechanical) and linearly open (classical) structures in EPR-type experiments.

The two fundamental descriptions of the unit circle, found at the sub-classical level, are also evidence of the nature of dualism found in what is fundamental. The trigonometric values are established by interpolation using two criteria:

1. the dimensional neutrality of a particular vector. If the vector is not neutral, the square-root function must be applied because the vector crosses a boundary to a lower dimensional platform.

2. the number of dimensional boundaries crossed and, importantly, not their classical lengths.



(adjacent/hypotenuse)^2 (based on values determined under IToE)

$\sqrt{3}/2 = 0.87$	$\sqrt{2}/2 = 0.71$	$\sqrt{1}/2 = 0.50$
$(0.87)^2 = 0.75$	$(0.71)^2 = 0.50$	$(0.50)^2 = 0.25$
$= \cos^2(30)$	$= \cos^2(45)$	$= \cos^2(60)$

Figure 8. The figures show the relationship of positions and directions to the values generated as trigonometric functions. The hypotenuse is the only dimensionally neutral plane. All others project and end across dimensional boundaries. The 'horizon' of the inner shell limits the angle of the hypotenuse. Points $p1$, $p2$, and $p3$ are rotated positions that project around this inner null domain. Ratio values are determined by the number of parts and their cross-dimensional structure not unit length.

One of the main concepts of IToE is that dimensional complexity must develop. Values within any numbering system or rotation within a geometric system must develop across boundaries. Values and rotations remain incomplete until full dimensionality is infinity complete. As such, the full range of rotational values in 180 degrees cannot be derived because the complexity of this model is inherently restricted to two dimensions. For more values to be represented (developed) the model would have to extend into higher dimensional plains. The values established by this simple model (restricted to two dimensions) are for 30, 45, and 60 degrees. The central null domain represents an horizon and limitation for angularity in the two-dimensional structure.

Finally, each of the three values is established from a separate observational perspective in rotation around the circumference, not a single location. This follows naturally from the fact that quantum mechanical structure is based on non-distributive relationships. In other words, rational relationship for the whole cannot be interpreted from a single position.

7. Conclusion

Polarization is an ideal phenomenon to present the relationship between sub-classical and classical structures. The transformation across rotational and linear formats and the presence of paradox in a domain constructed as a singularism/dualism is demonstrated.

The key elements of the Impressionist Theory of Everything (IToE) illustrated here are:

1. Paradox is a systemic and fundamental mechanism in the universe. Under this limitation, fundamental structures have, as a minimum, two formats that are not reducible to a singular principle of construction.

2. A mathematical and geometric model is derived from analysis of the inferences that follow from the assumption that paradox is a natural mechanism.

3. A principle of conservation applies for the relationship between two absolutely separate dimensional levels (sub-classical and classical). The sub-classical level is the support and developmental precursor to structure that is classically based.

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REFERENCES

1. Herbert, Nick. 1985. Quantum Reality, New York: Doubleday.