THE SIMPLEST POSSIBLE UNIVERSE

The presentation of a physical system having only one kind of particle - antiparticle pair

$$SPU = \sum_{1}^{\infty} (p_n^- + p_n^+)$$

One of the great achievements of the twentieth century was the discovery that every symbol belonging to every language, every sound, and every visual image can be replicated by sequencing on and off micro-switches. The combinations made possible by a binary-based electronic system are endless.

A universe comprised of only one kind of particle and its antiparticle would have a base two physical system. This book investigates the possibilities of such a system. Its finding is that such a pair, interacting through two fundamental engagement principles, called here Y and V, could easily create a physical system much like our own.

David Lee Cale

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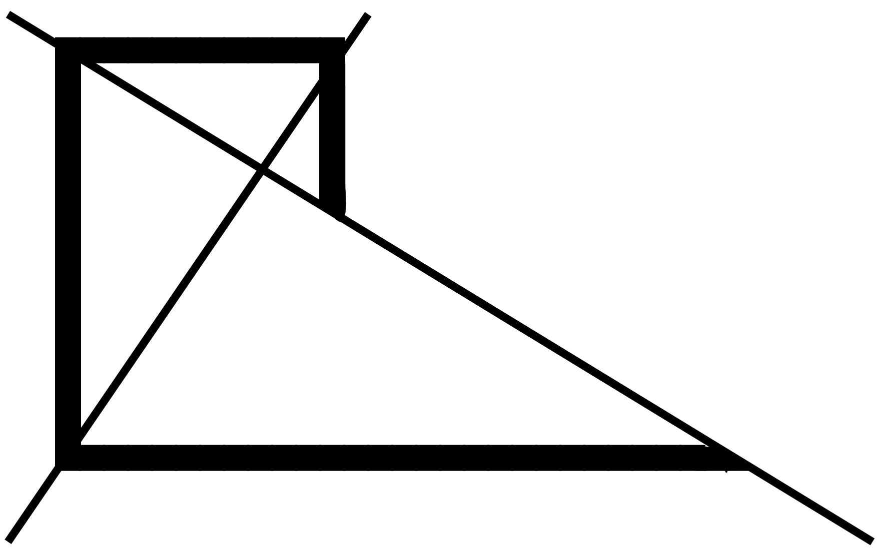
David Lee Cale, Ph.D.



MATHEIA SOCIETY PRESS

Matheia Society Press
Matheia Society Foundation
65 West Main Street
Uniontown, Pennsylvania 15401

Printed in the United States of America
Library of Congress Cataloging-in-Publication Data

Third Publication in a Series

The Simplest Possible Universe: Reflections on a Yin Yang Interpretation of the Quantum
Matheia Society Press, 2010
The Simplest Possible Universe: An Essay on the Ontological Structure of Spacetime
Matheia Society Press 2011

Printed through a grant from the

Matheia Society Foundation

ISBN – 13: 978-0-9817108-2-2
ISBN – 10: 0-9817108-2-4

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The Simplest Possible Universe

Through consciousness, the universe comes to know of its own existence. But, can consciousness evolve into minds that can come to know the universe as it is in itself, as it is at its most fundamental level? Should the goal of attaining such knowledge be humanity's calling? Is the accumulated knowledge of humanity a sufficient foundation for such a goal?

Humanity has traditionally believed this calling is given only to gods. If we believe in God, then our proper calling is to seek to know God and play the role of the lesser. If we reject the existence of gods then we are confronted with the recognition that, if the universe is to come to know itself as it is in itself, then, in this place and time, that calling passes to us.

If we choose the path of pragmatism and wish only to walk the firm ground of certainty as it is to experience, then we pass that calling on to others. If we take up that calling, we must study the universe, not only as it is to the eyes of our instruments, but also as it might be where our instruments cannot go. With this we enter the realm of possibilities, not as humans but as the universe itself and ask: What am I?

DLC

Preface

I believe we live in the simplest possible universe. The first purpose of this book is to explain why I believe this; the second is to offer a new interpretation of the quantum.

One of the great achievements of the twentieth century was the discovery that every symbol belonging to every language, every sound, and every visual image can be replicated by sequencing on/off micro-switches. The combinations made possible by a binary-based electronic system are endless.

A universe comprised of only one kind of particle and its antiparticle would have a base two physical system. This book investigates the possibilities of such a system. Its finding is that two basic particle interactions, called here Y and V, could easily create a physical system much like our own.

The methodology used is that offered in my 1980 book *The Basics of Consequentialism*. The term consequentialism had been used by Elizabeth Anscombe in an article titled "Modern Moral Philosophy" (*Philosophy*, 1958). The essence of her view is that all human acts have moral consequences. By the late 1970's the word had become popular in philosophy, especially with utilitarian philosophers.

I had by that time created what I present in Chapters One and Two, a model for a universe having a physical system consisting of an intrinsic law of equal opposites which expresses itself as an infinite number of positive and negative quanta and two rules for interaction I call the Y and V.

For human acts to have moral consequences, it can only be that what follows can be predicted. Prediction requires the presence of underlying fixed laws. It can be argued the three most fundamental ethical principles in our universe are: equality through fair sharing; fair reciprocity as equal exchange; and the conservation of individual rights. The Y and the V interactions conserve the rights of the intrinsic law through fair sharing (Y) and equal exchange (V).

While I found it interesting that my physics held 'ethical' principles, it also presents what might be called *physical consequentialism*. Traditional thought is imbued with the idea that the laws of nature are purely regulative, external to objects. In this view, objects, themselves, cannot create *ad hoc* laws through unique properties belonging to their physical state. Said otherwise, the laws of nature are not hierarchical. In my SPU theory, the laws of nature evolve as consequences of underlying principles.

Raging at that time, as through much of the twentieth century, was the determinism vs. indeterminism debate. Epistemological determinism was not at issue. Quantum mechanics had proven for all, or at least most, that experience is stochastic. The debate was and is ontological. Properly stated it is: Are there underlying causal principles governing the probabilities found in nature? The debate, which continues to the day, is between three factions: those who believe underlying principles equate to our descriptive laws, those who believe otherwise, and pragmatists who believe the debate unworthy of their time.

Pragmatists have a point. All theoretical arguments, to be published, are required to begin with empirically known facts and then, using the rational certainty supplied by mathematics, march into the world of the unknown. There is in this the problem of circularity. If we begin with the principles of experience, then we can only ascribe to the hidden principles of nature the principles of experience. Our test instruments are on our end of the chain, not the other. Thus, with accepted procedures, metaphysical arguments cannot be tested. I saw in the methodological reasoning of my physical consequentialism a way to test metaphysical theories.

We humans, by nature, see ourselves as spontaneous creatures having free will. We therefore welcome cosmogonies where matter can appear without cause. In thinking this way, quantum based creation theories usually ascribed an intrinsic law of spontaneity to unbounded empty space. The problem with spontaneity is that it undermines the principle of conservation.

Universal simplicity demands a fundamental law of conservation. A universe where laws and particles can magically pop into existence would not be, in the long run, as simple as one eternally having only one fundamental law.

I see in physical consequentialism a midpoint between determinism and indeterminism. On the one hand, when a new state is created, e.g. a proton captures an electron, a substance, hydrogen, is created along with a law governing how hydrogen interacts. This is spontaneous creation. On the other hand, the character of that hydrogen atom is ultimately fixed by the properties of its components. To discover what is truly fixed and irreducible at the Planck scale and what owes its existence to patterns formed by interactions between those things fixed, one can only play the game of "What if?"

The most propitious place to begin the game of "what if?" is with the question: What is the simplest possible physical system whatsoever? The truly simplest possible universe (SPU) would be unbounded empty space eternally conserved as such. This would mean that its unboundedness and duration would hold, not a law of everything possible, but two intrinsic laws of conservation: one for unboundedness and one for unchangingness. Further, for space to be one thing, the two laws would have to be mutually expressed as one law. I found positive and negative SPU quanta, and their fixed speed, to be the product of this mutual expression.

As for what takes place at the Planck scale in our universe I can say nothing. However, as for what takes place at the Planck scale in this model, I am an expert because I created its laws. I know with certainty, for example, that were the CH74 experiment placed in the SPU, coincident hits will tend toward $cos^2\theta + .005555\theta/90^o$ rather than $cos^2\theta$, as predicted by Bell's theorem. If our universe is the SPU, the same will be true here. I am hopeful that, someday, that test will be revisited with this model in mind. Similarly, I would like to see the test I propose on the back cover of this book done someday.

This model serves as proof that it is indeed possible to create Planck scale theories that can be tested. In one such test, conducted at Laurel Caverns on July 13, 2016, two slide projectors were set at right angles to each other such that the concentration of light immediately exiting the one must cross, at 90^o, the path of the concentration of light immediately exiting the other, when both projectors are lit. The finding is that, at the level of optical perception, the image on the screen for each projector is indifferent to whether the companion projector is on or off. Further, a third screen, set between and at 45^o to the other two screens, is not illuminated when both projectors are lit. This experiment strongly supports the granular interpretation of light offered in this essay. The de Broglie model for light, which holds that a photon propagates as an extended continuous field when at the speed of c, is discredited by this simple experiment.

It may be that SPU physics will be rejected and forgotten. But, in that a binary system is minimal for the achievement of differentiation, no one will ever produce a cosmogony, able to evolve a particle that naturally slows in proportion to the distance traveled, using less.

David Lee Cale
May 15, 2017

1

An Intrinsic Spatial Law of Conservation

1.0 Overview

After a thorough review of the history of the Newtonian, the electromagnetic, the relativistic and the field interpretations of mass, Max Yammer concluded his 1961 work, *Concepts of Mass*, with these words: "In spite of the concerted effort of physicists and philosophers, mathematicians and logicians, no final clarification of the concept of mass has been reached."[1]

In the years that followed, search for the essence of rest mass gave way to a search for the origin of mass-energy. In both relativity theory and in contemporary quantum mechanics, there exists the sobering suggestion that everything popularly called matter is, in fact, an expression of energy. But from where does mass-energy come?

Those searching for the answer to this question took a variety of approaches. Contemporary string theories are an example of one. Here, theorists apply mathematical reasoning to the empirical descriptions of physics as the compass for their journey into the *terra incognito* of Planck scale reflections. The highly regarded work of Edward Witten is in this tradition.[2]

Another approach might be called possibility theory. In this, the laws of relativity theory and quantum theory are assumed to fully exist at the dawn of the universe. In that quantum theory allows for the appearance of subatomic particles out of nothingness and general relativity holds that matter creates gravitational energy; when added to the assumption the Hubble redshift is a Doppler shift, these theories were utilized to argue that mass-energy arose out of empty space through a law of possibility.

Edward Tryon offered quantum theory's vacuum fluctuation as an explanation for the singularity, the intensely hot point of birth for mass-energy assumed by expanding universe theory.[3] Alan Guth's inflationary universe theory is in the tradition of energy-from-possibility with the suggestion that a Higgs boson spontaneously emerged to instantly create a gravitationally induced energy field of enormous proportions.[4]

With the discovery of so-called antimatter, the ancient Chinese philosophy of *yin-yang* found new life in the suggestion that it might be possible to make something from nothing without destroying the conservation of matter, providing an equal and opposite anti-something is also made.[5] This gave possibility theory another avenue, one advanced by Richard Tolman's observation that total energy in a closed universe is zero.[6]

Postulating an expressionless universe as its primordial state, Alexander Vilenkin's *ex nihilo* cosmogony, took this path also. His law of possibility permitted the zero of the nothingness to spontaneously divide into two equally-opposite energies, positive matter-energy and negative gravitational energy. He interprets primordial nothingness to be permissive, even to the point that it not only allows our universe to take place within it, but many others as well, each operating under its own distinct principles. In Vilenkin's multiverse, each of these spontaneously generated universes is separated from the others. Ours is but one in an infinitely extended emptiness that allows any number of physical systems. Our laws of physics thus evolve from the whimsical nature of our own spontaneous nucleation.[7] The problem with all these models is that they do not explain why the speed of light is a constant.

1.1 How Directionally Emerges in the SPU

While Vilenkin was exploring the *possibility* fork in *neo yin-yang* cosmology, I had already taken the *conservation* fork. My goal was not conformity to quantum theory but conformity to special relativity theory. I could not see how anyone could credibly argue that the constancy of the speed of light is an artifact of some uncaused hick-up within the depths of unbounded empty space.

My starting point was to investigate, not our universe, but the simplest possible universe (SPU) as unbounded empty space. This universe cannot be a point or some curved ball of space. In what would this ball sit other than unbounded empty space? Those who have not thought out the question: “Would universal empty space express extension?” might wish to consider the question: “If universal empty space cannot express extension, on what basis is it able to hold objects, galaxies for example, that do express extension?” Those, who believe our universe is a multiverse, infinitely extended and holding many physical systems, have no choice but to agree that empty space expresses extension.

Therefore, the SPU cosmogony begins with a massless universe comprised only of unbounded emptiness where Ø represents the property of universal emptiness and E that of universal extension. The question then becomes: How do these two properties express themselves?

For Ø, the expression is one demanding that the quantity of the SPU be zero and eternal unchangingness its quality. For E the expression is one demanding that the quantity of the SPU be infinity and unending extension its quality. The letter *T* is used to represent the self-expression of Ø and the letter *D* is used to represent the self-expression of E.

These two intrinsic expressions must coexist in a way that preserves both the measure of zero demanded by *T* and the measure of infinity demanded by *D*. Also to be preserved is the quality of eternal unchangingness demanded by *T* and the quality of unending extension demanded by *D*. The extension of space must be empty and the emptiness of space extended, everywhere and forever.

This 'must be' can only emerge as an intrinsic relational law of conservation; let ∪ represent the 'must be' union between *T* and *D*. This required union must merge the qualities and quantities of both expressions. *D* must 'go into' *T* and *T* must 'go into' *D*. This creates two new qualitative sets, each holding, in some way, the properties of both *T* and *D*. The union of *T* and *D* is captured by Equation 1.

$$SPU = T \cup D = \left(\frac{T}{D} + \frac{D}{T}\right) \qquad \text{Eq. 1}$$

The relationships *T/D* and *D/T* now need to be quantitatively defined. This model's suggestion is that the process of 'going into' first causes both *T* and *D* to quantize. Further, if each quantum expresses itself as an equal opposite, both the demand of *T* that the net quantity of the SPU be zero and the demand of *D*, that the net quantity of the SPU be infinite, is met. In Equation 2, lower case indicates the quantum state.

$$\left(\frac{T}{D} + \frac{D}{T}\right) = \sum_1^\infty \left(\frac{t^+}{d^+} + \frac{t^-}{d^-}\right) + \sum_1^\infty \left(\frac{d^+}{t^+} + \frac{d^-}{t^-}\right) \qquad \text{Eq. 2}$$

I now argue that these two sets must directionally align. With this, *n* emerges as a particular alignment of equally opposite directions, *n* also representing a whole number ≥ 1, in a set without limit. These alignments are the spacetime lines of the SPU. Though in Equation 3 the pluses and minuses are replaced by arrows, these arrows are to be understood as both geometrically and qualitatively opposite, as if right-to-left is negative in character and left-to-right is positive in character.

$$T \cup D = \sum_1^\infty \left[\overleftarrow{\left(\frac{t}{d}\frac{d}{t}\right)} + \overrightarrow{\left(\frac{t}{d}\frac{d}{t}\right)}\right]_n \qquad \text{Eq. 3}$$

1.2 How the Intrinsic Law Functions as the Prime Mover in the SPU

Equation 3 offers an infinite number of equally opposite directionalized quanta. For every direction in the SPU there is an equal and opposite direction. Further, each direction holds five concepts that now need to be defined.

There is first the relationship *t/d*. From *t* each direction acquires unchangingness and from *d* particularity as one, as a quantum. Let *t/d* be defined as an unchanging quantum of directed extension and given the symbol μ. This symbol represents how extension must embody itself in the presence emptiness.

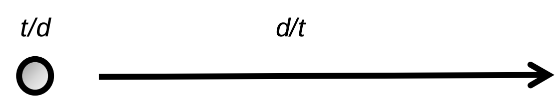
There is, second, the relationship *d/t*. From *t* directed extension acquires emptiness and from *d* particularity as a unique direction. Let *d/t* be defined as an empty but infinitely extended vector and given the symbol *c*. Let this symbol represent how emptiness must embody itself in the presence extension.

There is third the unique alignment (*n*) represented by a direction and its opposite. Fourth, there is the requirement that every directionalized expression of μ*c* have an equally opposite directionalized expression. This can be met qualitatively. Let all *t*, directed 'right-to-left' in its association with *d*, be called *negative directed* in character and given the minus sign. Let all *t*, directed 'left-to-right' in its association with *d* be called *positive directed* in character and given the plus sign. Through this arrangement, the net temporal direction of the SPU is zero.

Finally, there is the relationship $\mu c = t/d \times d/t$. In this, two reciprocals take on the nature of equal opposites in a unique way. Here the principle is not that they sum to zero but that they equal 1.000.

Yet, how can an unchanging quantum extension (μ) express itself so as to equal its reciprocal infinitely extended vector (*c*)? Sketch 1.1 shows, in an intuitive way, how the intrinsic relational law of conservation is essentially a principle of equal opposites or, if one prefers, reciprocity.

Sketch 1-1



Consider *t/d* and *d/t* as equal opposites, anti-vector and vector.
It is easy to see how they are opposite, but how can they be equal?
They can be equal if the anti-vector expresses itself
at every point along the vector.
In this way *t/d* multiplies itself by *d/t* (t/d×d/t).

Given the above, Equation 3 can now be rewritten as Equation 4. The relationship μ*c* now emerges as a particle-antiparticle pair, one pair for every alignment in the universe, with each particle, one positive and one negative, always traveling (expressing across as *t/d* × *d/t*) at a fixed speed. Since this act of *expressing across* follows *c*, let the symbol *c* also be used for the measure of this motion.

$$\sum_1^\infty \left[\overleftarrow{\left(\frac{t}{d}\,\frac{d}{t}\right)} + \overrightarrow{\left(\frac{t}{d}\,\frac{d}{t}\right)}\right]_n = \sum_1^\infty \left[\overleftarrow{(\mu c)} + \overrightarrow{(\mu c)}\right]_n \qquad \text{Eq. 4}$$

In this model these particles are called directons. The term momenton is reserved for aggregates of like-charactered directons. Since each directon expresses itself as a least unit of momentum, the particle is given the symbol *p* ($\mu c = p$). With Equation 5, the net directionality, the net temporality, and their net relationship, viz. momentum, all sum to zero in the SPU.

$$SPU = \sum_1^\infty (p_n^- + p_n^+) \qquad \text{Eq. 5}$$

Equation 5 fully describes the SPU's intrinsic *contract* between its spatial property of eternal unchangingness, demanded by universal emptiness, and its spatial property of infinite extension demanded by universal unboundedness. This contract preserves the SPU's quantity of zero, needed by universal emptiness, through a concession by universal unboundedness to express itself as equal opposites. It also preserves the SPU's quantity of infinity, sought by universal unboundedness, through a concession by universal emptiness to express itself as an infinite number of equally opposite points (μc).

This contract exists as an intrinsic relational law of conservation. Importantly, this law, though regulative, is also constitutive. Can a stop sign law truly exist without physical pronouncement?
This law expresses itself as positive and negative quanta of momentum (p). Each is a *fist* of the law; intrinsically tied to each quantum is the infinity of the emptiness of its vector.

At this point the SPU is in total chaos, being comprised of an infinite number of spacetime points all traveling in every direction at the speed of c. The chapters ahead show how this chaos has the ability to resolve itself into a universe remarkably like ours.

Basic SPU Symbols

D	Eigenraum, the SPU's universal unbounded volume expressed as an intrinsic law of infinity
T	Eigenzeit, the SPU's universal unchangingness expressed as an intrinsic law of zero
=	Law as an intrinsic reciprocal relationship within the SPU forcing D and T to co-exist
n	A whole number between zero and infinity corresponding to a particular alignment as $1/TD$
d	One of two equally opposite unbounded directions within each expression of n
t	One of two equally opposite temporal directions within each expression of n
μ	The relationship t/d, an enduring quantum moment, time and distance as an SPU unit of mass
c	The relationship d/t, the quantum of speed. How the *law* makes t/d equal 1.000
p	The SPU quantum - a directon - the unit of momentum conveyed by the relationship $t/d \times d/t$
m	SPU aggregate mass, the count of μc within an SPU particle or ensemble of particles
m_p	A momenton, especially one defined by the number of directons it contains
m_o	A loopon (o), especially one defined by the number of directons it contains
E	Energy as a count of directed quanta, e.g. $E = uc = p$ or $E = (m_o + m_p)c$
q	Temporal character, either positive directed (q = +1) or negative directed (q = -1), SPU charge

1 Yammer, Max. (1961) *Concepts of Mass*, Mineola: Dover Publications. p 224
2 Atiyah, Michael (1991) On the Works of Edward Witten, Proceedings of the International Congress of Mathematicians. pp. 31-35
3 Tryon, Edward P. (1973) Is the Universe a Vacuum Fluctuation? *Nature*, vol. 246, pp. 396-7
4 Guth, A. H. (1981). The Inflationary Universe: A Possible Solution to the Horizon and Flatness Problems, *Physics Review*. D 23: 347
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6 Tolman, Richard (1934) *Relativity, Thermodynamics and Cosmology*, Oxford: Clarendon Press. p. 441
7 Alexander Vilenkin, (1982) Creation of Universes from Nothing, *Physics Letters*, vol. 117B. pp. 25-8

2

Physics 101 in the SPU

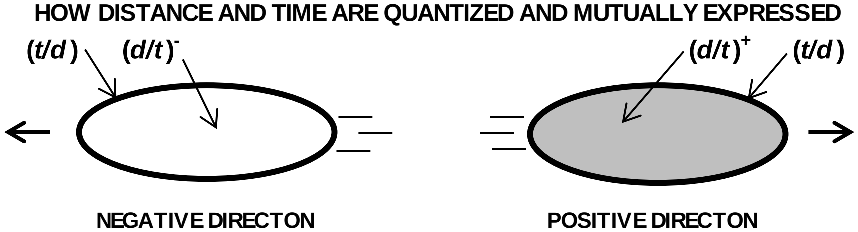
2.0 Overview

Chapter 1 provided a simple cosmogony beginning with three players: universal emptiness expressed as an intrinsic law of zero; unbounded extension expressed as an intrinsic law of infinity; and a universal intrinsic law requiring the two laws to be expressed as one. The product of this three-in-one package is a unified law, or relational law if preferred, that expresses itself as an infinite number of negative and positive quanta (p^- and p^+). As directed particles, these quanta are, beginning with this chapter, individually called *directons*. Each directon (*p*) is required to travel at the speed of *c* in either the positive or negative direction of its temporal sign along its fixed alignment (*n*).

The directon/distance density is set by the intrinsic law as 1/∞. Imagine two lead bullets in our universe, each 1 cubic millimeter in volume, fired in equally opposite directions into empty space. The volume of the path of each bullet would be π, times the bullet's radius squared, times the length of the path. If the path is unbounded its length is infinite. The bullet/path density can only be 1/∞. With this in mind and with apologies to anthropocentric interpretations of infinity, it can be understood how the density of directons in the SPU is 1/∞.

Sketch 2-1

HOW DISTANCE AND TIME ARE QUANTIZED AND MUTUALLY EXPRESSED



The time component (*d/t*) must move at the speed of *c*.
For every directon moving in the positive direction of *d/t*
there must be one moving in the negative direction of *d/t*.
Thus, every distance quantum (*t/d*) expresses
itself as two equally opposite directions.
Their paths create the geometry of SPU Spacetime.

Beyond being expressions of distance and time, directons play three additional roles in the SPU. First, each is a least expression of momentum. For this reason each is designated with the letter *p*. Second, each, as *t/d*, is a least expression of SPU mass. Here, mass refers to the number of directons. Directons are the building blocks of everything. All else only exists as patterns of directons.

Its third role is perhaps the most difficult to grasp. Regarding the question: "Of what is spacetime made?" this model can only suggest that the geodesic lines of spacetime descriptions are paths created by directons, the quantized relationship between unboundedness and emptiness moving through unbounded emptiness. Directons are 'made' only of intrinsic spatial law. Each a fist of the law, they are its only substance and their patterns of interaction create a secondary reality subject to the law.

SPU bosons and fermions would be massive hierarchical arrangements of directons. This book only considers two basic directon arrangements, momentons and loopons. At the scale of SPU physics, it might take millions of directons to form a stable momenton, millions of momentons to form a stable loopon, and millions of loopons to form one electron. To grasp the size of a directon, interpret Planck's discovery as a subatomic particle, having an antiparticle.

Though this model evolves its secondary laws of the SPU consequentially, it needs only one principle for its descriptions of the Y and V interactions, a principle of conservation conserving the fundamental law of reciprocity. Only through the conservation of directons can the unbounded distance of extension, the unchanging time of emptiness, and their relationship be conserved.

The Law of Directon Interaction

In every interaction between directons, the outcome must conserve the balance of equal opposites in the universe by conserving the net momentum, net character, and net directionality of all participants.

Given the law of directon interaction, the Y and the V interaction must be consequential to that law. By consequential, I mean that, given the formation of a new state defined as an association of directons created by previous states, the principles in the new state must conform to those in the previous states. [1]

The Y interaction is between like-charactered directons (negative to negative and positive to positive). The V interaction is between oppositely charactered directons (negative to positive). The shapes of these letters conform to the shape of the paths formed by their respective interactions. Section 2.1 provides the rule for interactions between two like-charactered directons; i.e. between two negative directons or two positive directons. Section 2.2 covers the V interaction.

Each directon's dimensionality must be conserved because it is a *particular* (a unique alignment) needed to make the universal whole complete. Whether negative as past-directed or positive as future-directed, quantum character must be conserved to preserve the balance of equally-opposite directionality. Additionally, the fixed speed of c (d/t) must be conserved. Another approach to this claim is to ask how the distance quantum ($1/d$) can equal unbounded distance ($d/1$). What propels $1/d$ to express itself across $d/1$? Let the intrinsic law be in the form t/t. Then one has $1/d \times t/t \times d/1 = 1.000 = p$. Again, c is the fixed velocity of time necessary for each quantum to equal 1.

All SPU distance, time, and law are embodied in the directons. Indeed, distance and time are themselves expressions of the law. Inevitably, in their journeys through the vast SPU emptiness, these directons must interact with each other. The task of this chapter is to show how these interactions conserve directon character and momentum within the law embodied by directons.

If each directon is designated by that which does not change, i.e. its momentum ($E = \mu c = p$); and if all directons are either temporally positive directed ($q = +1$) or negative directed ($q = -1$) [*these arrows are not our past and future*];[2] and if for every possible alignment ($n = 1, 2, 3...\infty$) in the SPU there is one positive and one negative directon; then the net directionality, the net time, and the net momentum of the SPU are all zero. Given this, a directon, as the quantum of SPU momentum, can be symbolized as:

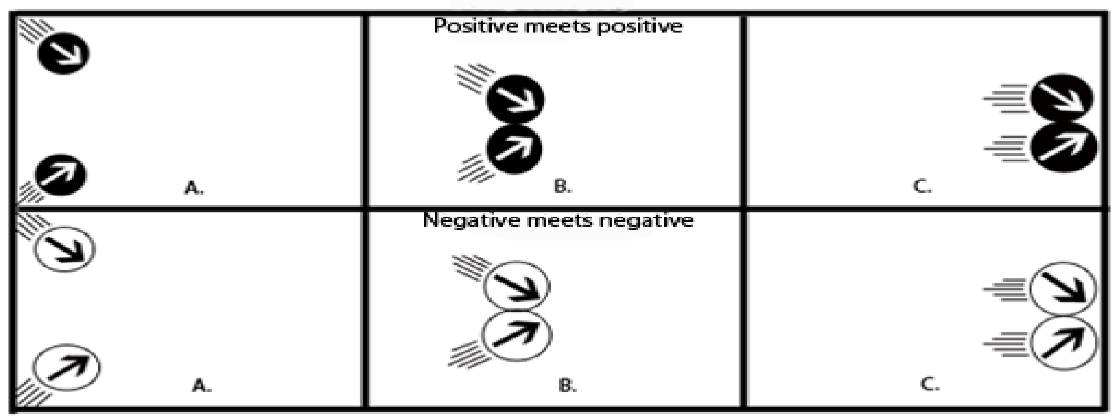
$$p_n^q$$

Each directon is a reversible monopole. These monopoles have only three possible interactions among themselves. Either it is the case that a positive meets a positive, a negative meets a negative, or a positive meets a negative. In experience, like-charges repel. That case also arises in the SPU when magnet-like particles called loopons evolve. Loopon structure is covered in Sections 2.3, 2.4, and 2.5.

2.1 Y Interactions and the Emergence of Momentum Aggregates in the SPU

The Y interaction (*vector summation*), like two soft clay balls colliding in midair, creates a resultant direction based upon the momentum of each. Two directons, having the same temporal character, i.e. sign, differ only in directional alignment. They achieve momentum conservation through directional sharing. Equation 6 is that for two positive directons having directions i and j. The resultant particle is a momenton (m_p) with a mass (m) of 2.

Sketch 2-2

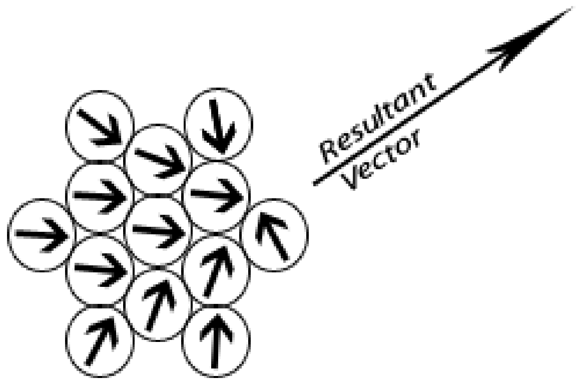


$$p_i^+ + p_j^+ = 2p_{\frac{ij}{2}}^+ \qquad \text{Eq. 6}$$

A shown in Sketch 2-3, the Y interaction allows any number of directons to participate. The internal arrows portray how each directon maintains its alignment in the resultant particle whose speed, of course, must equal c. These resultant particles lend themselves to a number of names; *clumpon* has been used in the past. For purposes here, they will be called momentons. The notation m_p will be used for momentons where the count of like-charactered directons contained therein needs to be expressed as a variable.

Sketch 2-3

A "momenton" and its packing arrangement as formed by Y interactions



Momenton

Designated with the symbol m_p, this SPU particle is formed when Y interactions create an aggregate of like-charactered directons.

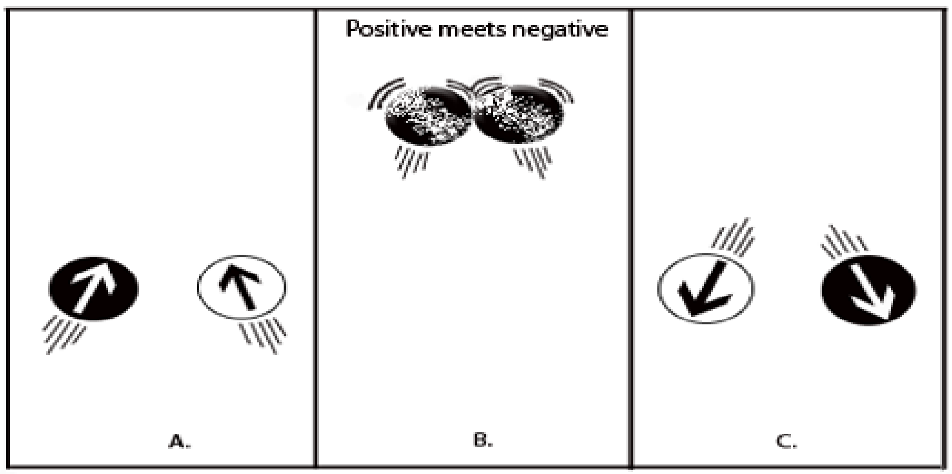
2.2 V Interactions and the Emergence of Directional Reverse in the SPU

The V interaction can be understood as an exchange of temporal modes. Sketch 2-4 and Equation 7 describe the Y interaction for two positive momentons. The resultant created by the V interaction makes distance a variable by creating angles in directon paths.

Y interactions between like-charactered directons (*p*) are captured in Sketch 2-2. They achieve momentum conservation through directional sharing. Equation 6 is that for two positive directons having directions *i* and *j*. The resultant particle is a momenton (m_p) with a mass (*m*) of 2.

When a negative and positive directon meet, the outcome of the interaction must preserve the alignment (*n = i, j,k...*) of each directon and the net negative and positive character in the SPU. This could be easily achieved if both alignments were able to pass through each other (an X interaction). In Euclidean geometry, an infinite number of straight lines can pass through a single point.

Sketch 2-4



$$p_i^+ + p_j^- = p_i^- + p_j^+ \qquad \text{Eq. 7}$$

However, SPU geometry is not Euclidean and each SPU directon is made of law expressing itself as distance and time. This model does not allow two directon alignments to pass through each other, only their temporal modes, and, accordingly, cannot allow an X interaction for directons. The simplest resolution is for the two quanta to exchange their most superficial trait. Hence, each directon (*p*) can only maintain its speed (*c*) and dimensional alignment (*n*) by accepting the temporal mode (+ or -) of the other when meeting an oppositely charactered directon. (This process also works if regarded as an exchange of polarity.)

Each directon is a quantum of alignment and this alignment sets its path. Its direction of travel along this path is determined by its character, that is, by its directional mode (negative or positive). When this minimal alignment (the directon) takes on an opposite temporal character it must reverse its direction of travel. Thus, the former positive directon, now a negative directon, must travel the negative arrow of its embodied dimensional alignment. Alternatively, the former negative directon, now a positive directon, must travel the positive arrow of its embodied dimensional alignment. All SPU properties are conserved.

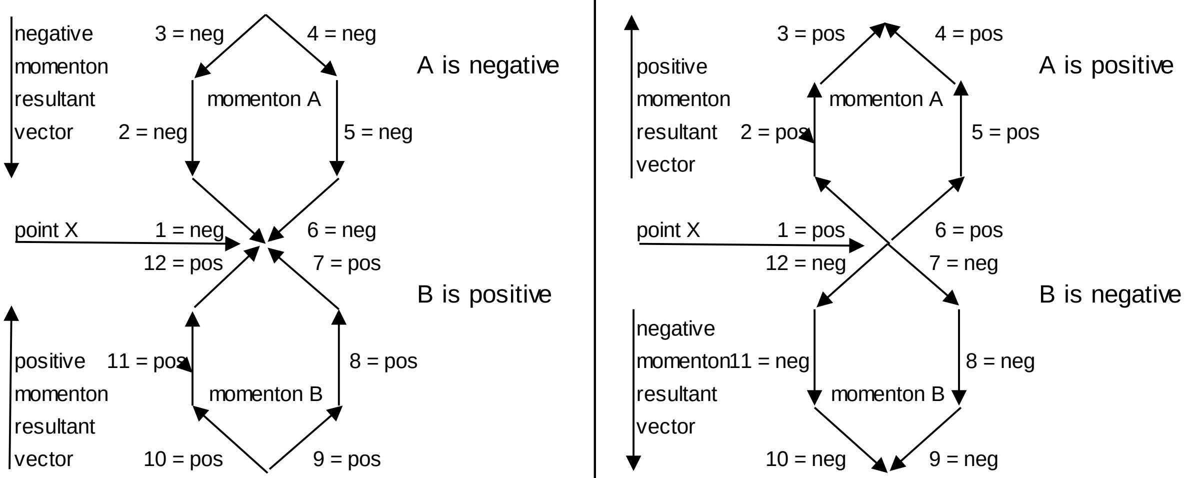
It is easy to see how large momentons can exhibit the Y interaction. But the V interaction for such aggregates must take place directon by directon. Sketch 2-5 describes the V interaction for two opposite momentons each having six directons. It shows that this interaction takes place on a directon by directon basis. The more interesting cases are those where momenton sizes are unequal.

Sketch 2-5

How Momentons Exhibit the V Interaction

Below, two opposite momentons have just met within a loopon loop at point X. The diagram represents a highly simplified and idealized directon packing arrangement. The directons are numbered. Initially, directons 1 through 6 are negative and 7 through 12 are positive

The exchange which takes place next is described below. After the exchange, momenton A is positive, continuing in its original direction and momenton B is negative, also continuing in its direction. This exchange demonstrates the conservation role played by the V interaction.



A step by step description of the directon to directon exchanges for the above transition.

		1	2	3	4	5	6	X	7	8	9	10	11	12
0	initial state	neg	neg	neg	neg	neg	neg		pos	pos	pos	pos	pos	pos
1	6&7 and 1&12 exchange	pos					pos		neg					neg
2	next eight directons trade	neg	pos			pos	neg		pos	neg			neg	pos
3	now all twelve trade	pos	neg	pos	pos	neg	pos		neg	pos	neg	neg	pos	neg
√	3&4 and 9&10 are locked*			pos	pos						neg	neg		
4	only eight directons trade	neg	pos			pos	neg		pos	neg			neg	pos
√	2&5 and 8&11 are locked		pos	pos	pos	pos				neg	neg	neg	neg	
5	6&7 and 1&12 exchange	pos					pos		neg					neg
√	all directons are locked	pos	pos	pos	pos	pos	pos		neg	neg	neg	neg	neg	neg
6	Both momentons are now free to leave point X and pursue their resultant vector at the speed of c.													
*	Locked simply means that those directons will no longer be re-directed by other directons in the schematic.													

This interaction can occur both between free directons (as in interference) or within loopon loops.

Equation 7 is generalized below to describe the case for two oppositely charactered momentons of different masses (m) where $m_1 > m_2$. Here, i & j are their alignments. However, the outcome produces a third residual momenton having path k. The effect of small momentons (p_k), randomly released from SPU matter might function like directons. Chapter Five covers SPU attractive forces.

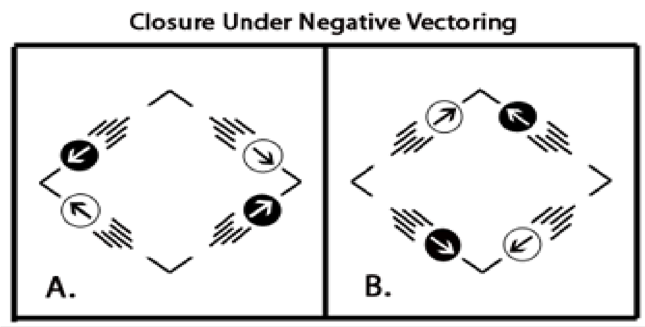
$$m_1 p_i^{+} + m_2 p_j^{-} = m_2 p_i^{-} + m_2 p_j^{+} + m_{(1-2)} p_k^{+} \qquad \text{Eq. 7-gen}$$

An interesting feature of the V interaction between two stable momentons turns on their ability to form closed loops. Momentons can grow in size through Y interactions or diminish through V interactions. Their stability is in their numbers and their packing arrangements; the Y and V interactions also allow for another kind of arrangement, here called *momenton loops*. These loops allow for the existence of rest mass in the SPU. SPU rest mass is merely looped momentum.

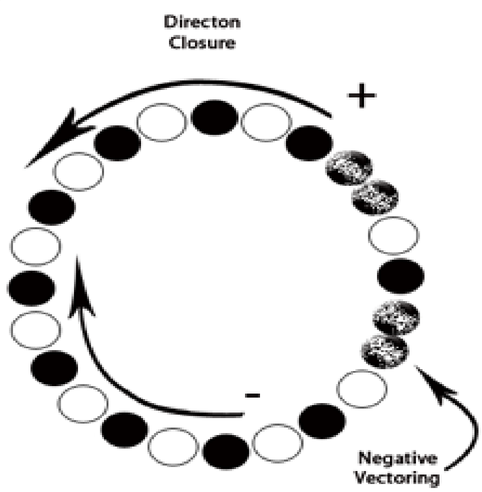
2.3 Looped Momentons as Rest Mass in the SPU

Since the Y interaction forms a vector sum, the V interaction can be regarded as creating a vector subtraction, called here *negative vectoring*. Our physics has nothing like this because it lacks the antiquantum. In a concentrated field of momentons, closure, the fundamental relationship needed for the forming of loopons, can take place. Sketch 2-6 idealizes closure using a four momenton model. Of course, the probability needed for stability would require large numbers of large momentons.

Sketch 2-6



Sketch 2-7



During the reversals depicted in Sketch 2-5, the V interaction is conducted by individual directons within momentons. This means closure will be characterized by a continuous flow of negative temporal character, say clockwise, and a continuous flow of positive temporal character in the opposite (counterclockwise) direction.

Momenton loops are essentially alternating (- & +) momentons in closed circular arrangements, governed by the V interactions of Sketches 2-4&5. Loops made only of free directons would likely be subject to statistical instability; they would "evaporate." However, when packed as momentons, the directons would be arranged such that they hold in place. Momentons not so arranged are "selected out" of the loop. Sketches 2-6 and 2-7 idealize the way the V interactions between oppositely charactered momentons can create stable vibrating loops.

Each momenton's back and forth motion allows it to maintain the speed of *c* even as it is "locked" within the loop. When the space between individual momentons in a looped string of alternating momentons (pos-neg-pos-neg-pos-neg) becomes sufficiently tight, the back and forth game of "tag" depicted in Sketch 2-6 is replaced by momentons continuously in a state of exchange (Sketch 2-7). Positive and negative character flow in opposite directions. This back and forth motion through the V interaction is called, here, negative vectoring. The locking of momentons, what can be called directon closure, would create opposing flows of character akin to opposing force lines in magnetic fields.

A single loop, by itself, would likely not be stable. But, when two loops are joined via the Y interaction, as in Sketch 2-8, their union is made stable by the larger momentons forming their intersection. The Y interaction has the ability to bond loops. The nature of the Y interaction would allow many loops to intersect to form a momenton column. Since this column is at the center of the momenton loops they can be said to form a class of particles that can be called loopons. Loopons are the subject of the next section.

2.4 The Loopon

Just as the momenton is the fundamental "boson" of the SPU, the loopon serves as its fundamental "fermion". The loopon plays the same role in the SPU that rest mass plays in our universe. Its ability to attract momentons and other loopons, as well as accelerate and decelerate, brings relativity to the SPU. Sketch 2-8, offers an idealized cross-section of a loopon *loop set*.

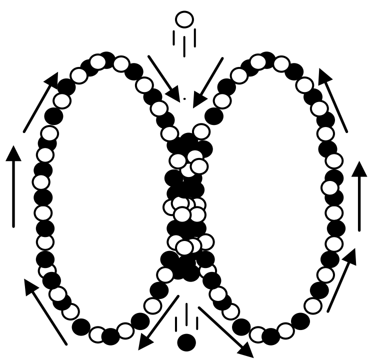
Loop sets are best regarded as concentric, i.e. onion skin layered. The particle, as a whole, would likely resemble a scintillating "apple" with positive momentons being expelled at one end and negative momentons at the other. This sketch reveals how the Y interaction works at the loopon's core. It allows individual loops that would likely have extremely short lifespans to be made stable. The Y interaction binds the like-charactered momentons at their respective positive and negative poles.

Though a momenton is a monopole, a loopon is a bi-pole. The loopon core is essentially comprised of momentons in constant states of reversal (or exchange if one prefers - see Sketch 2-5). Every momenton within the loopon is vibrating back and forth at the speed of *c*. Hence, the negative and positive characters flow in opposite directions through the loopon's loops and core at the speed of *c*.

Sketch 2-8

<u>Cross-section of the loopon</u>

Arrows indicate the flow of positive directionality.
Negative directionality goes in the opposite direction.
Of course, the reverse would work just as well.



At the "top" of the core, the positive character is "clumping" through Y interactions; conversely, at the "bottom" of the core, the positive character is being taken apart by V interactions. That is, at the bottom the positive character is divided to be passed along that portion of each loop not comprising the core of the loopon. The reverse is taking place for the negative character.

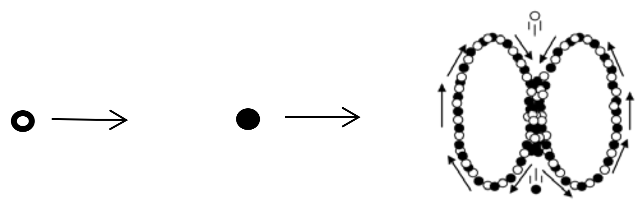
The loopon's core is held together by the binding ability of the Y interaction and ties each loop to all others. The loops, made of momentons, are held together by a binding force, or perhaps better said: *activity*, created by the V interaction.

It is easily seen that loopon structure somewhat mimics the structure of magnetic force lines with positive character flowing in one direction and negative character always flowing in the equally opposite direction. A perfect loopon is perfectly symmetrical with no resultant direction; it is motionless. It has no external momentum in its own right. Every internal direction is opposed by an equally opposite direction. In the chapters that follow I reveal how loopons attract each other. With this ability, like a string of beads made of small block magnets, loopons can form super-loopons. But for loopons to move as loopons, they need their own time arrow. This is covered in Chapters four and Seven.

2.5 How SPU Light Creates Transverse Vibrations in Loopons

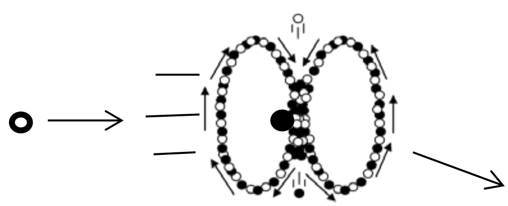
As shown in the next chapter, for SPU light to exist, it must be that alternating sprays of positive and negative momentons exist in the SPU. Momenton loop decay provides the source of these alternating sprays. One of the interesting features of this model is that, when a loopon is struck by alternating positive and negative momentons, it will vibrate transversely to their path of propagation. Sketch 2-9 shows the initial condition; a positive momenton followed by a negative momenton is about to be incident upon a stable loopon.

Sketch 2-9



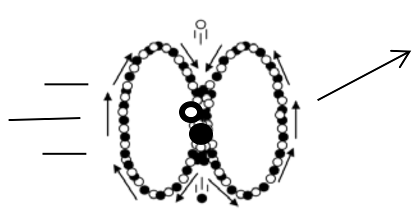
When the positive momenton strikes the core of the loopon (Sketch 2-10), its zone of greatest stability and highest density, it will form a Y interaction with positive momentons in the core. Since, in this example, the positive character moves from the loopon's "north" pole to its "south", the directional influence is downward. Correspondingly, if the incident positive momenton interacts with a negative momenton in the core, a similar effect will take place because the north bound negative character will be reversed by the V interaction to a south bound positive character.

Sketch 2-10



When the negative momenton strikes the core of the loopon (Sketch 2-11) it forms a Y interaction with negative momentons in the core. Since, in this example, the negative character moves from the loopon's "south pole" to its north, the directional influence is upward. Correspondingly, if the incident momenton interacts with a positive momenton in the core, a similar effect takes place because the south bound positive character will be reversed by the V interaction to a north bound negative character.

Sketch 2-11



1 See pages 9-20, Cale, David L. (1980) *The Basics of Consequentialism*, The Philosophy Press

2 See Chapter Seven

3

The Nature of Light in the SPU

3.0 Overview

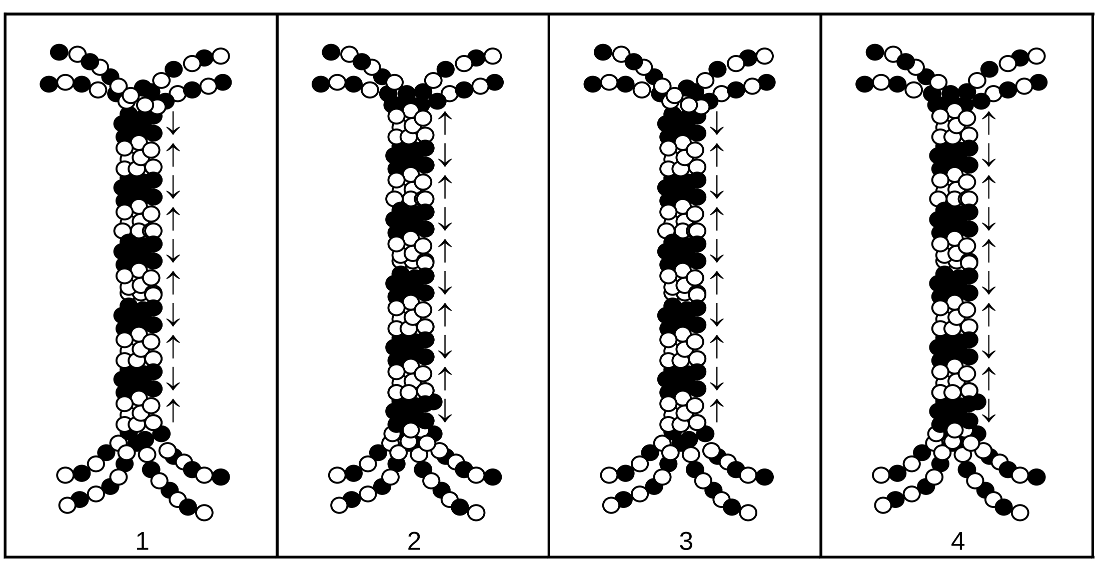
This chapter first shows how the particles developed in Chapter Two are capable of producing granular light. It then demonstrates how this light has the ability to exhibit interference and diffraction. A primary argument against granular light is that it cannot do these things. Given the V interaction in the SPU, it can. The SPU physical system evolves from the fact that the intrinsic law of self-conservation, belonging to the nature of unbounded emptiness, fragments spatial extension into equally opposite *least particulars* (positive and negative quanta) committed to express unboundedness. This commitment takes the form of fixed motion. The quanta, i.e. directons, and their motion create dimensionality as the spacetime fabric of the SPU. SPU Light is created by the way loopons store and release momentons.

3.1 The Many Possibilities for Loopon Configurations

Each momenton's back and forth motion allows it to maintain the speed of *c* even as it is "locked" within a loopon. Recall that when the space between individual momentons in a looped string of alternating momentons (pos-neg-pos-neg-pos-neg) becomes sufficiently tight, the back and forth *game of tag* depicted in Sketch 2-6 is replaced by momentons continuously in a state of exchange (Sketch 2-7).

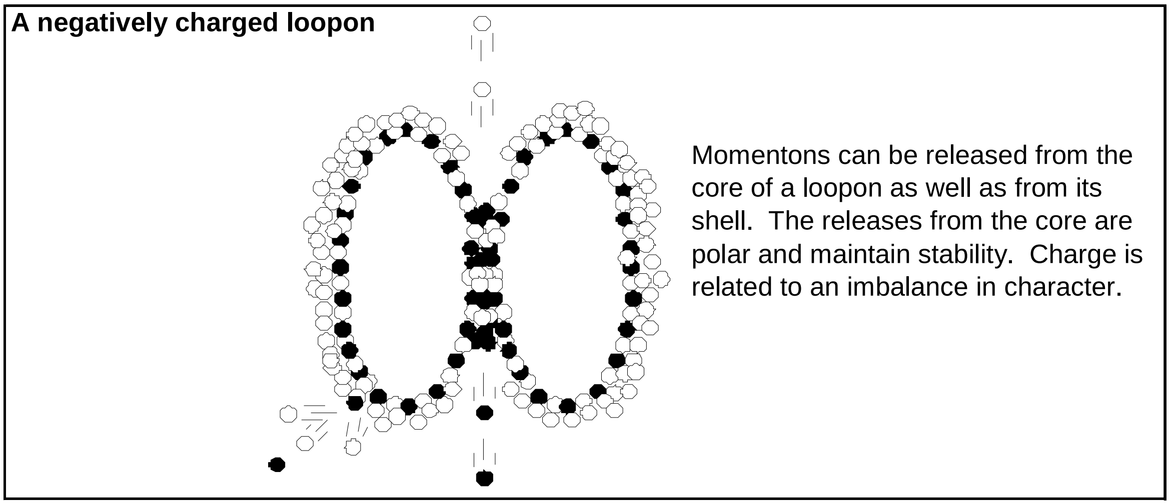
As shown in Chapter Two, the loopon core is comprised of momentons while its outer portion is made of any number of onion-layered closed loop, the latter made only of oppositely signed (+ or -) momentons. Positive character always flows at the speed of *c* in the opposite direction of negative character in loopons. Sketch 3-1 portrays a loopon core, the heart of its rest-mass. The positive character is flowing downward and the negative flowing upward in this example. If a loopon's momentons become too big to have their character fully absorbed by the core’s structure, negative momentons will escape from the core’s negative pole and positive momentons from its positive pole.

Sketch 3-1



Sketch 3-2 shows the cross-section of a loopon encrusted by negative momentons, giving it a negative *charge*. Note the momentons escaping from the core. In this example, the *top* of the loopon will only emit negative momentons and the *bottom* will only emit positive momentons. This is the key to the structure of light in the SPU. Because of the continuous and opposing (i.e. bidirectional in the sense of a magnetic force line) flow of character in the loopons, one pole of the loopon must always be a positive emitter and the other always a negative emitter.

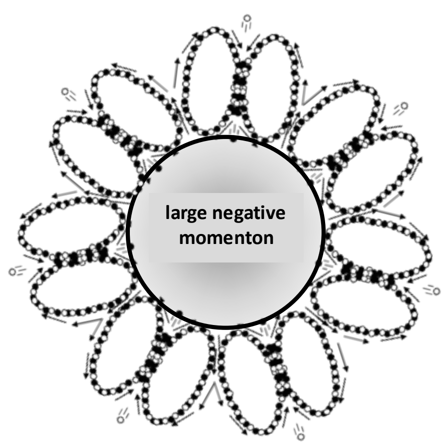
Sketch 3-2



Loopons can take on any number of forms. The possibilities are endless. The loops of large loopons can be made of small loopons, for example. This might be the most stable form. Were our universe the SPU, many of our subatomic particles would have such a structure. Every momenton is a 'charged' particle, but only in the SPU sense of having a positive or negative character.

Sketch 3-3 shows a momenton-loopon hybrid which might best be called a blumenon. If accelerated, its velocity would equal the mass (directon count) of the accelerating momenton divided by the sum of total rest-mass and the accelerating momenton's mass. Generally, a loopon is accelerated by an imbalance in its internal Y and V interactions. Hence, this particle would be expected to always travel at a high speed and appear to observers as having a negative charge. Note this version of a blumenon has the ability to emit surplus positive momentons where the loopons touch to form inter-loopon “cores”.

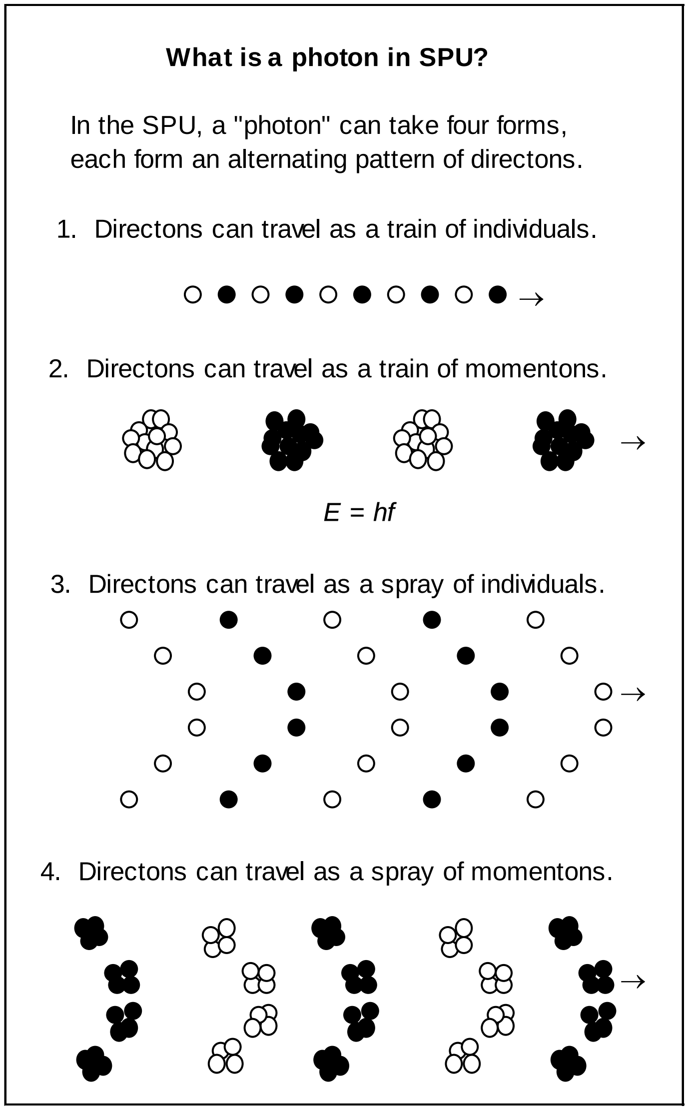
Sketch 3-3



3.2 The SPU Photon and its Possible Forms

A SPU photon can have one of four forms. These are portrayed in Sketch 3-4. The most common SPU photon would likely be the alternating (pos-neg-pos-neg-pos-neg) spray of momentons given in the last example. Were our universe the SPU, Planck's constant might represent the effect on experience of one positive and one negative momenton traveling in a train of such particles. Directons, tiny even to momentons, would be beyond the reach of individual measurement.

Sketch 3-4



To grasp how many directons a light-creating loopon might contain, one can transport Einstein's equation for the photoelectric effect ($\frac{1}{2}mv^2 = hf - \varphi$)□ from our universe to the SPU. If the work-function, φ, is ignored, then, <u>m will correspond to the "mass" of two momentons</u> ($\frac{1}{2}m = 1m_p$) and the velocity v to c, the fixed speed of each momenton. Assuming the minimal <u>two momentons in each "wave" cycle</u>, say a positive for "crest," and a negative for trough, Planck's constant, h, translates to the influence of one cycle (two momentons) and f is the number of positive momentons passing a given point per unit of time. Equation 8 provides the mass of one momenton for the case where $f = 1$.

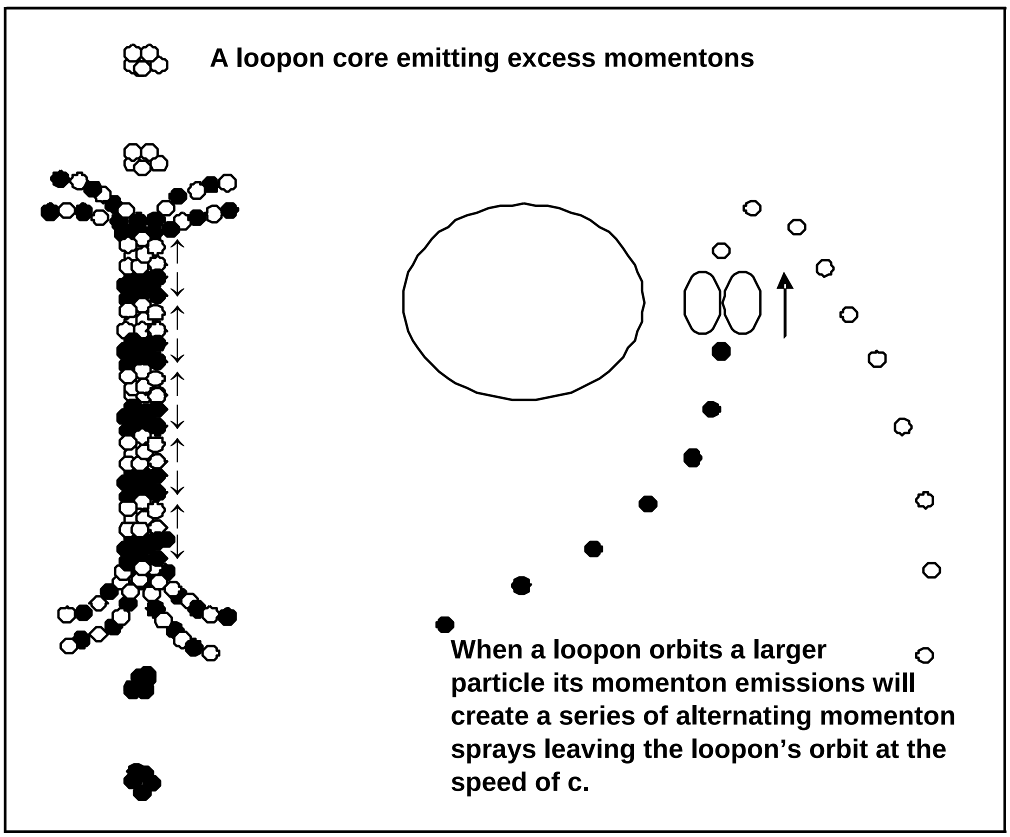
The mass of one momenton $$\frac{1}{2}m = \frac{h}{c^2} = 2.2\ x\ 10^{-51} kg.$$ Eq. 8

Since the rest mass of an electron is 1.67 X 10^{-27} kg, were an electron to be a SPU loopon, it would require 7.59 X 10^{23} momentons. If each momenton contains billions of directons then the measure of *h*, as the measure of two momentons, suggests individual directons can only reveal themselves as a device for explaining the behavior of momentons, e.g. how light is bent by the gravitational force.

Were a negative blumenon to be made unstable by a large influx of alternating positive and negative momentons, it would pulsate under the rules of the Y and V interactions; emitting negative momentons from its outward directed loopon cores and positive momentons where the loopons touch to form inter-loopon “cores”. These emissions would have a directional bias created by the direction of momentons striking the blumenon. The alternating sprays of positive and negative pulse-created momentons would become SPU photons. Free directons might escape as well.

Sketch 3-5 portrays an alternative scenario for photon creation in the SPU. It shows how a loopon, orbiting a larger particle, could also create an alternating spray of positive and negative momentons. Interestingly, these waves are not perfectly concentric, but rather logarithmic in their geometry.[1] Momentons would leave the loopon's orbit at the speed of *c*. In this model, wavelength would be a function of the velocity of the orbiting loopon.

Sketch 3-5



It is quite possible that a meaningful investigation into the various possibilities for the mechanics of light generation by loopons might reveal that both mechanisms, the pulse and the orbital, are involved. It can be now seen that the SPU, in its evolution, is extremely versatile. SPU Light might be formed in several ways. The collapse of a loopon's outer shell of loops is another.

3.3 Diffraction in the SPU

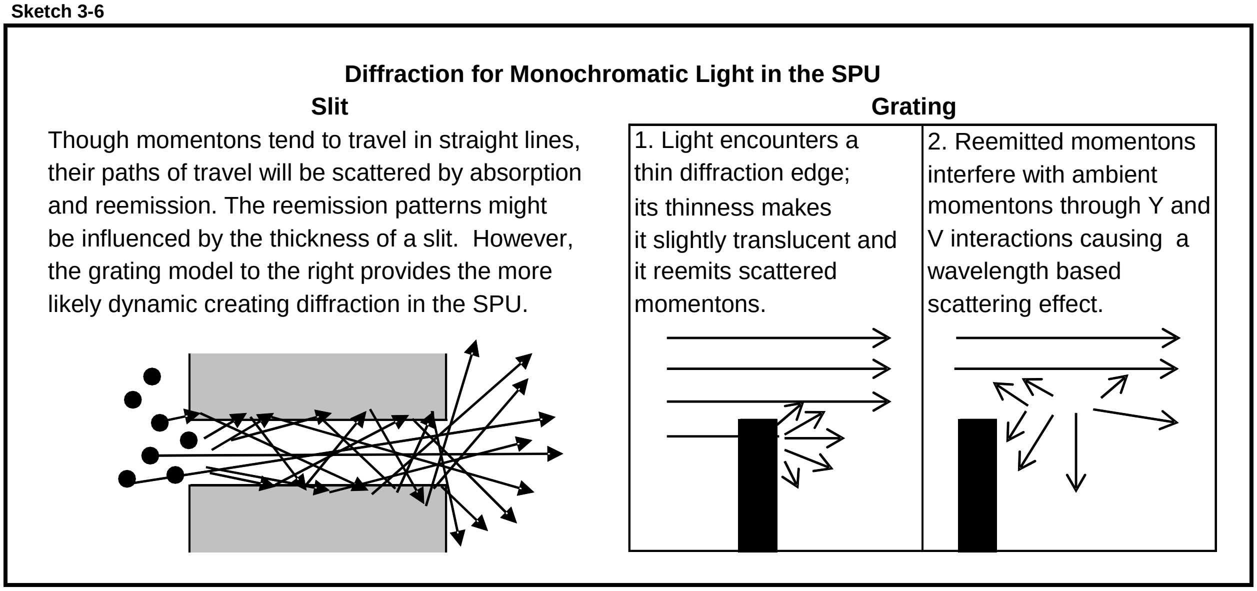
Another difference between our light and SPU light is in the way they respectively exhibit diffraction. Like air and water waves, light “bends” around corners. The mathematical model we use for light diffraction, as developed by Fresnel,[2] is consistent with the mathematical models applicable to air and water waves pioneered by Dutch mathematician Christian Huygens (1629-1695).[3]

However, in the SPU, momentons only travel in straight lines, except when affected by an attractive force. This means that, apart from an attractive force, the "bending" of SPU light can only be created as a consequence of absorption, re-emission, Y interactions, and V interactions. Sketch 3-6 provides an outline of how diffraction might take place in the SPU.

Physicists have long been aware that the mechanics responsible for interference might also be at play in diffraction.[4] Particular attention must be given to the fact that the thinness of a material’s edge plays an important role in diffraction. A slit can be regarded as a continuous edge and, though its thickness might play the role shown below, the SPU model is better served by the grating example which is more dependent on Y and V interactions.

Our interpretation of diffraction evolved from a need to define the ontology of light waves using what experience tells us about water and sound waves. For the latter, pressure at the molecular level accounts for diffraction. Absorption and reemission by obstructing materials play no role. This is not the case for SPU light. Sketch 3-6 offers a conceptual explanation for how diffraction works in the SPU.

Sketch 3-6



3.4 The 1909 Single Photon Two-slit Interference Experiment of G. I. Taylor

It is often the case that fame is disproportionate to the contributions one makes to the world. Sir Geoffrey Ingram Taylor offers a case in point. All philosophy of science students are familiar with the single photon two-slit interference experiment; yet few know that G. I. Taylor (1886-1975) was the first to perform this experiment and first to explore the implications of Thomas Young's light interference experiment from the perspective of Einstein's photon theory. His 1909 single photon two-slit interference experiment still serves as a pillar in the edifice of the standard interpretation of quantum mechanics.[5] But, what happens when his famous experiment is conducted in the SPU?

Though the idea that light is corpuscular goes back to Newton, Max Planck's discovery of the quantum finally dismantled all belief in the infinite divisibility of energy. Further, Einstein's 1905 photoelectric theory requires that light exist as a particle with the ability to concentrate its influence upon one point. Yet, in 1800, Thomas Young proved that light exhibits interference bands. Since such evenly spaced bands had already been found in water interference phenomena, it seemed that light must have both a particle and wave structure.

To further explore this dualism, Taylor set up a monochromatic light source directed toward an opaque wall containing only two open parallel slits. The slits, being very narrow, passed on the light according to the principles of diffraction discovered by Fresnel. The symmetry of the slits with respect to the original source guarantees that the two secondary sets of light waves are also coherent. Just beyond this double slit wall, Taylor placed a photographic plate as a receiving screen. With a wavelength compatible with the apparatus, the light source will cause, of course, parallel interference bands to appear on the film plate. Classical interference requires the simultaneous involvement of both slits.

Taylor next turned down the monochromatic light source to a point so low that only one tiny dot of light would appear on the emulsion plate per short exposure (e.g. two seconds). In view of Einstein's recent photo-electric theory, Taylor interpreted this as implying that only one photon had been released by the highly dimmed light source during the exposure interval. All that was then needed was a series of trial exposures to confirm some average time between the appearance of individual dots of light so that Taylor could conclude that in, say, one minute he might have, for example, 30 dots of light on the plate, in 20 minutes 600 dots, and so forth.

Under the rules of wave cancellation and reinforcement associated with interference, a pattern of parallel bands comprised of many light dots would be expected to emerge on the film plate, were continuous light being transmitted from the monochromatic source. But, with the light source so reduced that, presumably, only one photon reaches the screen at a time, no pattern of interference bands would be expected in that a single dot could only mean the passage of a single photon and, therefore, the use of only a single slit by each photon.

Yet, given an exposure over time involving many dots of light on the photographic plate, each one statistically occurring, the parallel bands appeared on the developed plates. To add to the mystery, Taylor repeated this experiment with one of the slits closed. In this case, as would be expected under classical conditions, no interference bands appeared.

The only intuitive explanation for Taylor's experiment came some years later from the brilliant French physicist and Nobel laureate Louis de Broglie (1892-1987). His wave-particle model can be applied to both electrons and photons.[6] The essence of his solution is that, at "rest," a particle has the morphology of a classical particle; but, in proportion to its velocity, it takes on the mathematical morphology of waves in the tradition described by Huygens.

Thus, while it is readily said that quantum theory admits the ability of single particles to exhibit interference, this ability assumes that each self-interfering particle does so by acquiring the mathematical structure of waves. Current thought rejects the idea that deterministic non-de Broglie particles (i.e. subatomic billiard balls) can exhibit interference because experience does not provide "billiard balls" that can exhibit interference. In the SPU, the Y interaction lets light behave like soft clay balls.

Underlying the standard interpretation of the Taylor experiment and its descendants is the Kantian-like assumption that there exists a one-on-one correspondence between an emitted photon and its target reaction.[7] We all recognize that any making of a causal assumption will have us playing "a shaky game" with respect to our interpretations of nature.[8] This is why the "game" is intellectually challenging.

In the SPU, Taylor's assumption is unsustainable because each momenton is so tiny compared to the massive array of loopons needed to create even a speck of SPU matter that only an accumulation of momentons has the power to initiate either an energy cascade in a PMT (photon multiplier tube) or a scintillation on a film plate. Momentons, therefore, affect SPU atoms in a way more like our photons affect popcorn kernels. This “popcorn effect” allows SPU light to replicate the outcome of the Taylor experiment by redefining wave-particle duality as sequential sprays of grains (momentons) of light.

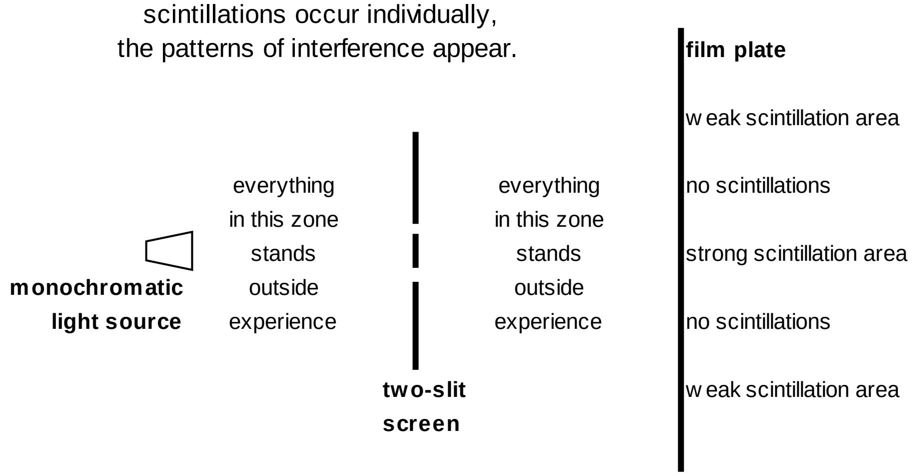
Sketch 3-7

The Taylor Single Photon Interference Experiment

There is no empirical linkage in the Taylor experiment between photon emissions at the light source and a scintillation event on the film plate. Immanuel Kant argued that our minds supply unseen connections so that we might explain nature. Though we reject Kantian philosophy in general, our claim that a film scintillation is caused by a one-on-one correspondence between a plate event and a single photon emission at the light source demonstrates his point. All that experience provides is what is shown below. In the SPU, the scintillations would be caused by a "popcorn" effect created by the absorption and re-emission of momentons by SPU particles. In the SPU, light is granular and the "single photon" is not singular, only the screen event is.

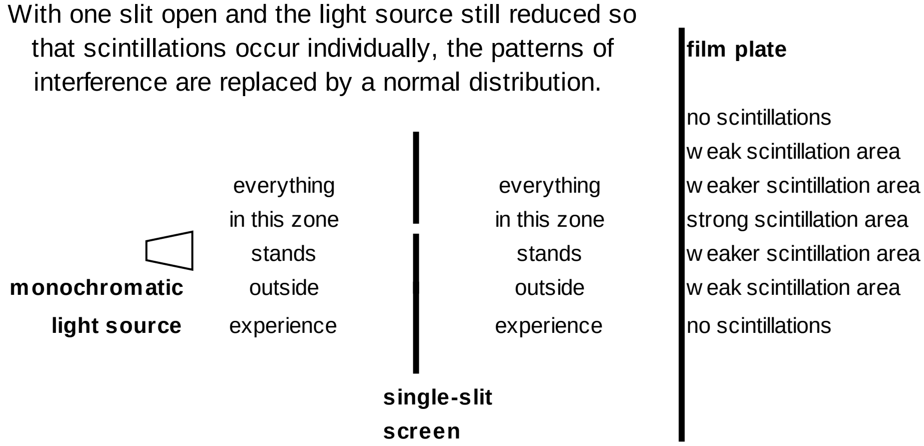
Part One

With both slits open and the light source reduced so that scintillations occur individually, the patterns of interference appear.

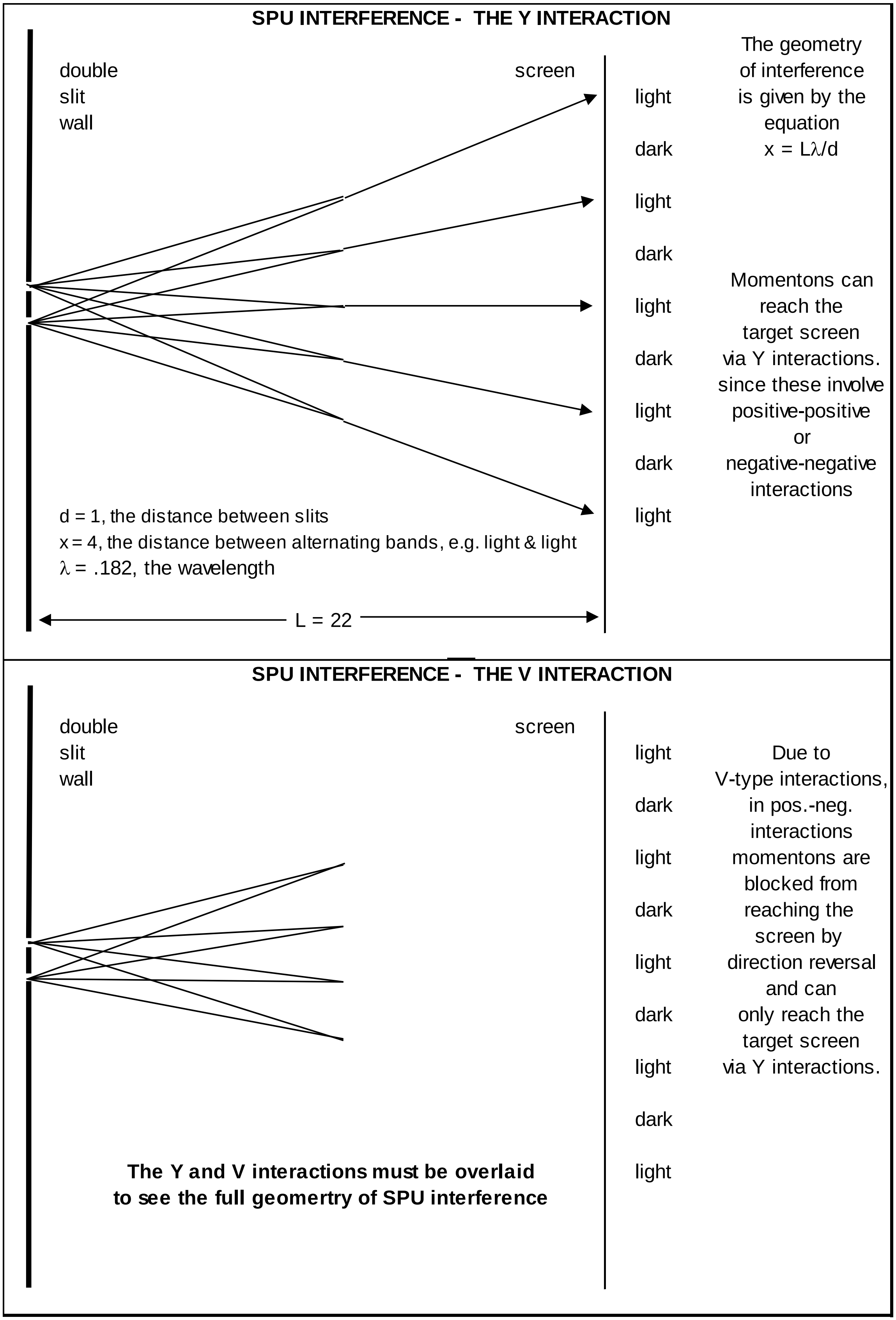


Part Two

With one slit open and the light source still reduced so that scintillations occur individually, the patterns of interference are replaced by a normal distribution.



Sketch 3-8

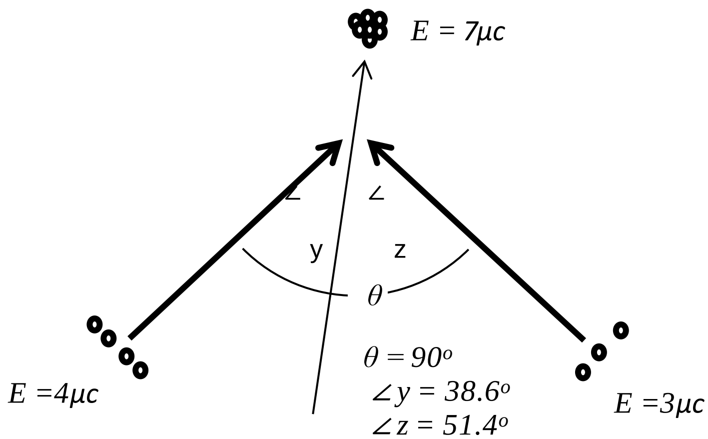

SPU INTERFERENCE - THE Y INTERACTION
double
slit
wall
screen
light
dark
light
dark
light
dark
light
dark
light
The geometry
of interference
is given by the
equation
x = Lλ/d
Momentons can
reach the
target screen
via Y interactions.
since these involve
positive-positive
or
negative-negative
interactions
d = 1, the distance between slits
x = 4, the distance between alternating bands, e.g. light & light
λ = .182, the wavelength
L = 22
SPU INTERFERENCE - THE V INTERACTION
double
slit
wall
screen
light
dark
light
dark
light
dark
light
dark
light
Due to
V-type interactions,
in pos.-neg.
interactions
momentons are
blocked from
reaching the
screen by
direction reversal
and can
only reach the
target screen
via Y interactions.
The Y and V interactions must be overlaid
to see the full geomertry of SPU interference

3.5 How SPU Light Exhibits Interference

Photon behavior invites a variety of descriptions; that provided by de Broglie's solution to wave-particle duality and that provided by Einstein's solution to the photoelectric effect[9] are two of the more familiar. Whatever the description, to be light, alternating aligned momentons must have the ability to exhibit interference. The key to this ability is in the geometry of the letters V and Y, the same geometry allowed to directons by the principles of interaction needed to conserve the intrinsic law.

Sketch 3-9 involves nothing more than elementary trig. It simply shows how the resultant direction created by two groups of directons, each coming from a different source, upon merging through the Y interaction, create a momenton in compliance with the conservation of the law. The difference between angles *y* and *z* is proportional to the mass differences of the two directon groups.

Sketch 3-9



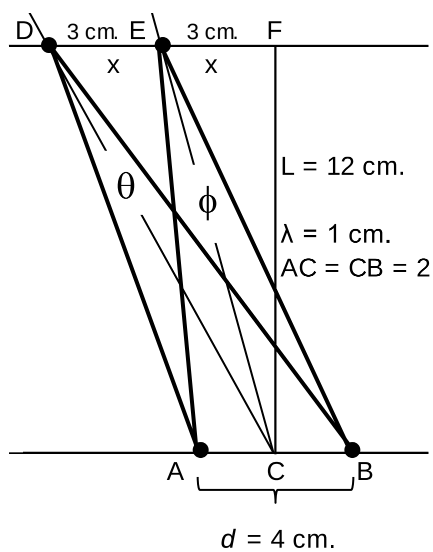
Sketch 3-10 shows how this same rule, applied to a series of uniformly spaced (λ) momenton wave fronts, creates the familiar equally spaced interference screen bands. While the density of the momentons is inversely proportional to the square of their distance from sources A & B, the relational strength of the converging momenton wave fronts are at any point linearly inversely proportional.

Sketch 3-10

$X = L\,(\lambda / d)$

The relational strength (density) at any intersection is inversely proportional to the distance of each involved momenton from its source, A or B.

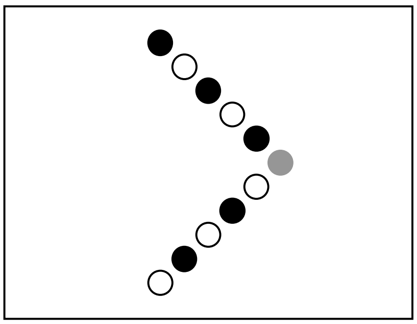
$\angle ADC = (AD/AD + BD)\ \theta$
$\angle CDB = (BD/AD + BD)\ \theta$
$\angle AEC = (AE/AE + EB)\ \phi$
$\angle CEB = (EB/AE + EB)\ \phi$



Chapter Two showed how momentons exhibit the V interaction. The V interaction blocks oppositely charactered momentons from advancing by requiring each to reverse its directionality (Sketch 3-11). Alternatively, the Y interaction allows momentons to advance in a direction chosen by compromise, i.e. vector summation (Sketch 3-12).

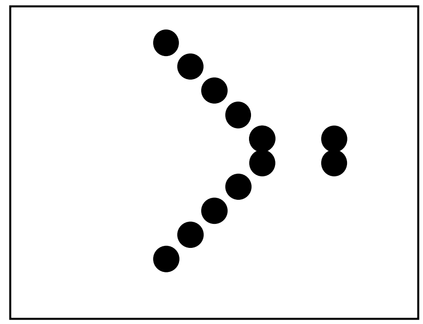
V interactions block momentons from reaching a target screen.

Sketch 3-11



Y interactions conduct momentons to a target screen.

Sketch 3-12



Sketch 3-8 shows the SPU interpretation of the Taylor experiment based on the above analysis. The Huygens-like wave crest-trough structure is replaced by alternating sprays of positive and negative momentons. Where V interactions take place (at crest-to-trough intersections), the momentons are blocked and returned. Eventually all momentons reach the screen. However, they can only do so through the net vector summing provided by the Y interaction. Since our physics lacks V interactions, it cannot explain how deterministic non-de Broglie particles can exhibit interference. This model shows how it might be that photon self-interference is an illusion created by a belief in Young's assumption.

In the SPU, wave-particle duality takes the form of alternating sprays of momentons. They are waves in the sense that a line of soldiers marching onto a field is a wave; and, they are particles in the sense that each wave is a composite of individuals. This section has shown that such discontinuous waves have the ability to exhibit interference. In the final picture, both the Y and the V interactions participate in interference; the former representing crest-to-crest and trough-to-trough re-enforcements and the latter representing crest-trough cancellations.

3.6 The Hubble Redshift in the SPU

On the question of whether or not my simplest possible universe is expanding or static I cannot say. My model is compatible with expansion theory because every directon is obligated to travel at the speed of light. Further, given the infinite extension of the SPU, a field of highly concentrated directons 20 or 30 billion light years across (an “inflaton” field) would not tax the proportions of the model. Such a field would even help explain loopon formation.

But I encountered an interesting implication of the model when I sought to explain (to myself) how a SPU photon as a momenton "train" (alternating positive and negative momentons sharing a common vector) could travel great distances without scattering. In resolving that problem, I found they would be naturally redshifted through the process outlined in Sketch 3-13.

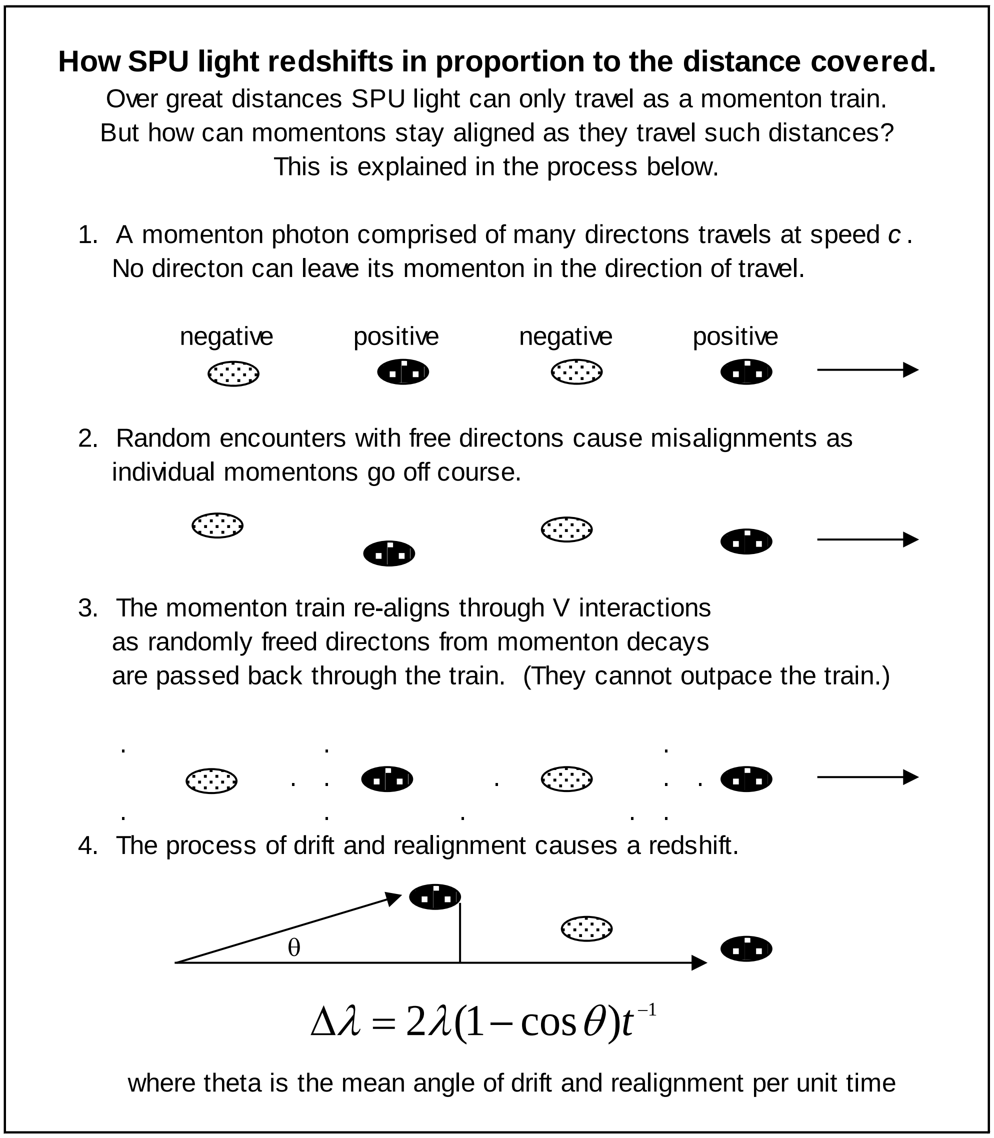
If the SPU is not expanding, it would still have a uniform radiation backdrop created by free momentons not aligned as light. Indeed, the presence of such a backdrop, and relatedly the presence of dark energy as rogue momentons, is a prediction of this model.

The first key to understanding Sketch 3-13 rests on the fact that momentons must always travel at the speed of *c*. The second key is that each momenton in the train could easily hold 10^{15} directons and still be 10^{-8} smaller than an electron in our universe. Hence, if a momenton is gravitationally affected by a free directon (as shown in Chapter Five, free directons create a gravitational force), a small momenton decay will take place discharging free directons of the character of the momenton, either positive or negative.

Further, none of these freed directions can affect momentons ahead of it on the axis of travel. They can only affect momentons behind the decayed momenton. Chapter Five reveals how momenton decay works and why it would create a SPU attractive force on sequential momentons. Simple geometry will show that, as the momentons in these light trains drift from outside influences and realign from the SPU attractive force, they must redshift. Equation 9 provides a conceptual approximation of the amount of redshift ($\Delta\lambda$) in one cycle (t) of drift and realignment where θ represents the average angle of drift, especially where $45^{o} > \theta > 0^{o}$.

$$\Delta\lambda = 2\lambda(1-\cos\theta)t^{-1} \qquad \text{Eq. 9}$$

Sketch 3-13



Equation 9 represents an approximation for only one given drift and realignment cycle. As the SPU photon travels across the universe the wavelength (λ) will be continuously lengthening. The gravitational influence of any momenton on the momenton behind it is inversely proportional to the square of the distance between them. Hence, as the distance increases, the angle θ will tend to increase as the attractive force weakens. This means that the SPU redshift will not be linearly proportional to the distance traveled but, rather, exponentially proportional! In Chapter Five, another redshift factor, the way in which SPU gravitation slows light, is also discussed. But, that slowing is resolved by the decay process and not permanent in the way this redshift is, though perhaps both are operative.

Realignment redshift is believed impossible in our universe because our photons are not believed to be granular. The SPU redshift also requires the V interaction absent from our physics. But again, I must point out that in interpreting the Hubble red shift as a Doppler shift we have merely applied a relationship within experience to the unseen world of subatomic particles. This application might be correct; yet we must keep in mind we have never observed the act of expansion. All we can say with certainty is that light redshifts in proportion to the distance it travels. When we speculate on the cause of the redshift we leave the field of empirical science and enter, like SPU theory, the field of speculative cosmology.

---

[1] In *What is a Photon?* (Wyndham Hall Press, 2000), Irwin Wunderman makes an interesting case for the belief that light is granular. He too finds that light waves, as granular fields, must propagate from their source as logarithmic spirals (pages 155-166 and pages 275-288).

[2] Augustin-Jean Fresnel' thesis was written in 1816 and titled: Mémoire sur la diffraction de la lumière

[3] See Huygens, Christian, *Treatise on Light*, trans. S. P. Thompson. Leiden: P. Van der Aa, 1960.

[4] The most notable contributor to this view is perhaps Richard Feynman. See his *Lectures in Physics*, Vol., 1, 1963, Addison Wesley Publishing Company Reading, Mass.

[5] For a light review of this and other defining experiments in quantum theory see: Sheldon Goldstein, Sheldon's "Quantum Mysteries", *Science: New Series*, Vol. 263, No. 5144, 1971.

[6] Louis de Broglie won the 1929 Noble Prize in Physics for a credible solution to the mystery of wave-particle duality created by the 1909 Taylor two-slit interference experiment and its descendants. Roughly speaking, he recognized that in Einstein's photo-electric effect we have the mathematics for a photon "traveling at a speed of zero" at the point it ejects an electron and in wave theory we have the mathematics for a photon traveling at the speed of light. From these two extremes he created a mathematical synthesis that still serves us today as an acceptable interpretation of wave-particle duality. His 1953 book *The Revolution in Physics* (New York: H. Wolff) provides insight into his worldview. His original thesis is found in "Ondes et quanta," *Comptes Rendus 177*, 1923.

[7] Cale, David L., (2002) The Kantian Element in the Copenhagen Interpretation of Quantum Mechanics, ProQuest Information and Learning, Ann Arbor, MI. p. 12

[8] I am pointing out a double standard in the standard interpretation. See, for example, Arthur Fine's The *Shaky Game: Einstein, Reality and the Quantum Theory* (The University of Chicago Press, 1986). If we remove from the table what Kant called synthetic *a priori* judgments, we lose the right to use the expression "single photon experiments." We can only say: "single event experiments;" there can be no quantum theory as explanation, no interpretation of the Aspect experiment. It is easy to forget that Einstein's belief in a Planck scale *Gespensterfeld* within the Taylor experiment is no more speculative than the belief that a single event in a PMT tube is caused by a single photon. The "popcorn effect" offered by SPU physics is quite possible. Even Bell's theorem is ultimately underwritten and dependent upon the questionable assumption that electrons and photons are ontologically indivisible.

[9] For more on Einstein's ontological interpretation of light see "Physics and Reality," *The Journal of the Franklin Institute*, Vol.221, No. 3. March, 1936; and: "On a heuristic viewpoint concerning the production and transformation of light," trans. A. B. Arons and M. B. Peppard. *American Journal of Physics* 33, 367-374. 1965.

4

Kinetic Energy in the SPU

4.0 Overview

This chapter reveals how the Einstein-Lorentz equation for kinetic energy naturally arises in the SPU. It shows that the equation can be derived without reference to observer-based frames of reference. A key point is that, in SPU physics, mass change regulates velocity; it is not the other way around.

4.1 How the SPU Einstein-Lorentz Equation Can Be Derived in Seven Steps

Step 1: Set-up Initial Variables

Recall Equation 5. This section can be regarded as a continuation of Chapter One.

$$SPU = \sum_1^{\infty}(p_n^- + p_n^+)$$

A momenton (m_p), having the resultant direction (r) and character q (q being either + or -), can be described in terms of Equation 5. The infinity symbol must be replaced with the letter m, which, in SPU physics, represents the number of directons (p) within a particle, whether momenton or loopon.

$$m_p = \sum_1^m \left(p_n^q\right)_r$$

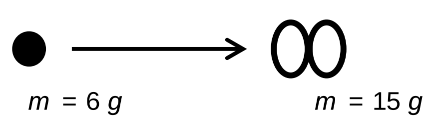
A loopon can also be described in terms of Equation 5. Ideally, it is that state where the sum of all resultant directions equals zero. Because its stability depends upon the V interaction, one is free to argue that the sum of all directon character, positive and negative, must also sum to zero. When SPU physics is treated as a game for purposes of entertainment, interesting loopon decay rates and acceleration equations evolve when imbalances in q and r occur. But, here, the initial state for a loopon is given as:

$$m_o = \sum_1^m \left(p_n^{(q^- + q^+ = 0)}\right)_{\left(\underset{r}{\leftarrow} + \underset{r}{\rightarrow} = 0\right)}$$

Assume a gravitationless vacuum and let m_p be a positive momenton with a mass of 6 gigadirectons (g) moving at the SPU standard for speed (c) such that c = 1.000c. One may make this speed of c any velocity one chooses; it won't affect the analysis as long as it is the upper limit for speed.

Let m_o be a perfectly balanced loopon, at rest, having a mass of 15 gigadirectons. This closeness in mass is chosen to avoid the measurement problems encountered, through closeness to the value 1.000, when more realistic proportions are used. Let the axis of incidence pass through the center of both. Let the term, velocity (v), be used for the post incident shared-speed of both particles ($v < c$).

Sketch 4-1



Step 2: Create a Proper Equation for Velocity

One can calculate the post incident velocity of loopon m_o, after impact by the momenton m_p, in two ways. The final answer must provide that momentum (here, designated with a capital *P*) equals 6*gc*, the momentum of the incident momenton. Because momentum (*P*) must be conserved and the loopon's acceleration can only come from the momenton, the proper equation for velocity depends upon the interaction elasticity of the two particles. Recall that *m* is the count of directons (*p*) where *m* = μc = *p*.

Were they like billiard balls, highly inelastic, then, one might expect the momenton to come to a state of rest after transferring all of its energy to the loopon. It would follow that $v = m_p c/m_o = .4c$. This answer would be correct since 15*g* ×.4*c* equates to 6*gc*.

However, the loopon can only absorb the momenton. The two particles will behave more like soft clay balls; in a sense they are highly elastic. The resultant mass is 21*g*. Momentum (with a capital *P*) is exceeded since 21*g* × .4*c* equates to 8.4*gc*. This approach is clearly incorrect for the case at hand.

Equation 10 is therefore the proper choice in this case. It correctly yields a post-incident mass of 21*k*, a post-incident velocity of .285714*c* and conserves momentum at 6*gc*.

$$v = \left(\frac{m_p}{m_{o+m_p}}\right)c \qquad \text{Eq. 10}$$

Step 3: Create a Proper Equation for Momentum

Given that momentum is defined as mass multiplied by velocity, Equation 11 is the first of two proper equations for translational momentum. To solve it, given Equation 10, one need know the mass of both particles. Keep in mind, SPU mass (μ) is not a fundamental substance, merely the relationship *t*/*d*.

$$P = mv = (m_o + m_p)\left(\frac{m_p}{m_o + m_p}\right)c = m_p c \qquad \text{Eq. 11}$$

Equation 12 also provides the proper outcome for momentum in this case. Yet, it does not require that one knows the mass of m_p. One needs only know: that *c* is the maximum for velocity, the rest mass of m_0, and the observed post incident velocity of the merged masses. In this case, *c* - *v* = .71429*c*. Since 15*gc*/.71429 = 21*gc*, it follows that 21*gc* - 15*gc* = 6*gc*, the proper value for momentum.

$$p = \frac{m_o c}{\left(\frac{c-v}{c}\right)} - m_o c \qquad \text{Eq. 12}$$

Step 4: Alter Eq. 12 with an Adjustment Term (*k*) for Velocity Change

In this case, the conservation of energy ultimately reduces to the conservation of momentum. Kinetic energy is scalar and correlates changes in momentum with changes in velocity. Let the velocity change multiplier be given the symbol *k*. Equation 13, though that for kinetic energy (*E*), still has the essential structure of Equation 12, that for momentum. Note that *k* must represent a number greater than 1.000 in SPU physics because it can only arise with a mass increase for the loopon. At *k* = 1.000, *E* equates to momentum, i.e. *k(c-v)* < 1.000*c* following acceleration.

$$E = \frac{m_o c}{k\left(\frac{c-v}{c}\right)} - m_o c \qquad \text{Eq. 13}$$

Step 5: Find the Value for k

For the loopon (m_o), the incidence event has three effects: the loss of identity as a mass without velocity, mass increase, and distortion of its perfect symmetry. This event has a reciprocal effect on the momenton (m_p). For it, there is: the loss of identity as an independent particle, the loss of velocity, and the deconstruction of its purity of character (positive or negative) through V interactions. Only its resultant vector is preserved through the direction taken by the accelerated loopon.

Accordingly, the relationship c - v, in Equations 12 and 13, belongs to the momenton. Since, k must have a value greater than 1.000, lest momentum equates to kinetic energy, k is best understood as a multiplier for that share of kinetic energy attributed to the velocity state (c - v). Said, generally, k is the numerical coefficient for a momenton's post-incident relational change in velocity. Therefore, it can be said that the proportional post incident change in the momenton is given by the relationship:

$$k\left(\frac{m_p c - m_p v}{m_p c}\right)$$

On the flip side (*1/k*), the loopon is enjoying a proportional increase in velocity. This can be shown by simply taking the above expression for the momenton's proportional change in velocity and rewriting it for the loopon. The proportional post-incident change in the loopon is given by the relationship:

$$\frac{1}{k}\left(\frac{m_o c + m_o v}{m_o c}\right)$$

Now, all that is needed is a solution for k in Equation 14. This is carried out below and given as Equation 15.

$$k\left(\frac{m_p c - m_p v}{m_p c}\right) = \frac{1}{k}\left(\frac{m_o c + m_o v}{m_o c}\right) \qquad \text{Eq. 14}$$

$$k^2(1 - v/c) = (1 + v/c)$$

$$k^2 = \left(\frac{1 + v/c}{1 - v/c}\right)$$

$$k = \sqrt{\frac{1+v/c}{1-v/c}} \qquad \text{Eq. 15}$$

In this example, k^2 = 1.285714 / .714285714 = 1.8. Therefore, **k = 1.341640786**.

Step 6: Place the Value for *k* into Eq. 13 and Solve

$$E = \frac{m_o c}{\sqrt{\frac{1+v/c}{1-v/c}}\left(\frac{c-v}{c}\right)} - m_o c \qquad \text{Eq. 16}$$

$$E = \frac{15gc}{\sqrt{\frac{1.285714}{.7142857}}\,(.714285714)} - 15gc = \frac{15gc}{.958314847} - 15gc$$

E = .65247584gc

Step 7: Recognize Eq. 16 as the Lorentz-Einstein Equation for Kinetic Energy

This recognition begins with the realization that the right side of Equation 15, multiplied by (c - v)/c equates to the Lorentz factor and, here, c = 1.000c. For this system, or any similar system involving the linear acceleration by and of inelastic materials in a gravitationless vacuum, the right side of Equation 17 will always equate to the left. In this case both provide the number .958314847.

$$\sqrt{\frac{1+v/c}{1-v/c}}\left(\frac{c-v}{c}\right) = \sqrt{1-\frac{v^2}{c^2}} \qquad \text{Eq. 17}$$

4.2 Why the Value of *K* Is Underwritten by SPU Y Interactions

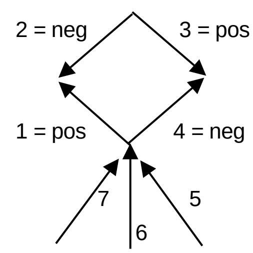
An interesting feature of SPU physics reveals itself when one contemplates how its intrinsic law of reciprocity can solve what can be called the SPU's *unstoppable force problem* (UFP). What happens when a directed momenton, committed to the speed of c, is incident upon a loopon committed to the speed of zero by the fact that its directons are already in a spin state at the speed of c? The answer to this question turns out to be that, as the loopon is accelerated, the internal directons must relationally slow such that each directon's internal relational speed, plus the loopon's acquired speed equals c.

Sketch 4-2 portrays the SPU's unstoppable force problem. A four directon loopon is, of course, too unstable to be possible; but the simplicity of the numbers eases the explanation.

Sketch 4-2

The "Unstoppable Force Problem" in Loopons

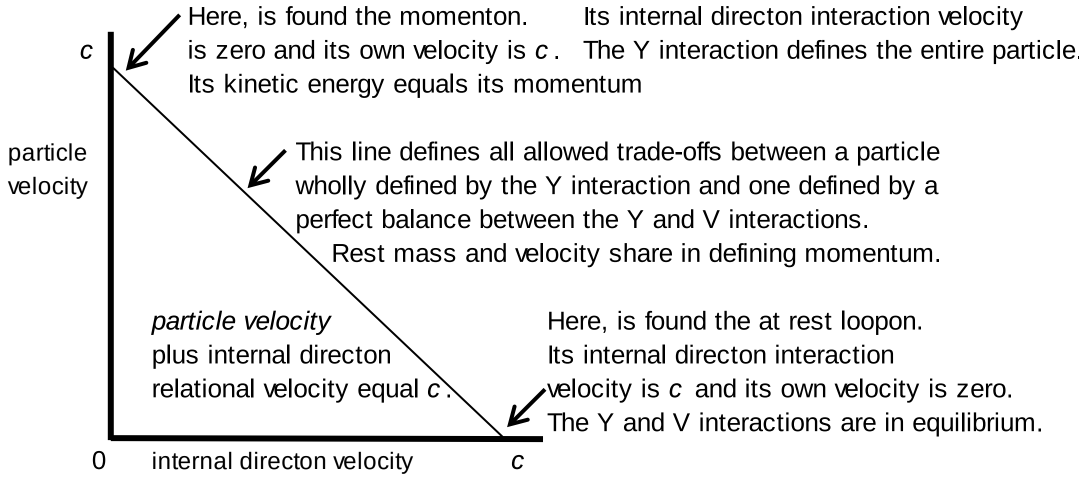
In the sketch at the right, directons 1,2,3, & 4 represent a closed loopon configuration where the directons are constantly reversing at the speed of c but going nowhere. Directons 5, 6, & 7 represent a clumpon which is obligated to move at the speed of c in a resultant vector now blocked by the loopon. If the loopon moves, its directons will exceed the speed of c. The clumpon can't reverse in this case. What happens next?



Recall that Sketch 2-3 idealizes the directon packing arrangement in a small momenton. In it, directons have no internal relational velocity. All internal directon motion is locked and given over to the whole, the momenton, through the Y interaction. In that the loopon is made of alternating positive and negative momentons, it too is held together by the Y interaction, especially at its core. The V interaction locks momentons in the outer loops. Momentum is thus conserved by the exchange of positive and negative character, one flowing clockwise, in the loop and the other counter-clockwise at the speed of c.

The key to solving the SPU's unstoppable force problem is in the recognition that relative internal directon velocity within a momenton is zero and within a loopon it is c. Since all directons must always travel at the speed of c, the source of the loopon's acquired velocity and the attendant momenton drop in velocity can only be from the ability of the loopon to unpack momentons through the V interaction and the ability of a momenton to accelerate like-character momentons through the Y interaction. As a loopon is accelerated its internal clock slows proportionally. Sketch 4-3 reveals the range of all possible directon-to-directon relational speeds between that within a free momenton and that within a momenton within a stable loopon.

Sketch 4-3



From this analysis, it can be seen that kinetic energy, the velocity driven portion of momentum, is dependent upon the dominance of the Y interaction immediately following the absorption of a momenton. It is a matter of similarity in momenton character (positive or negative) as well as the imposition of a momenton's resultant vector upon a loopon. Therefore, the value for K should naturally emerge in SPU physics from an analytic of Y interactions only. It does.

For the event described in Section 4.1, the positive momenton can only create a Y-based resultant vector with half of the momentons in the equally charactered loopon. That is, after the event, the resultant change in loopon mass is given by $\Delta m_0 = .5m_0 + m_p$.

The foundation of kinetic energy is given by the familiar equation: $F = ma$. From this rudimentary principle many equations follow, including the equation $E = .5mv^2$. Though not fully a proper equation for kinetic energy, it does derive from the equation $F = ma$ and therefore must hold some basic truth; but what basic truth?

All that can be said, here, is that, if it is interpreted as a formula for a relational loopon mass change and placed in the SPU, one must replace E with Δm_0 and v with k. Recall that k is the numerical coefficient for the velocity $c - v$, whose value is proportional to the mass of the incident momenton in the SPU equation for momentum (Eq.13). Because kinetic energy increases with the square of velocity, and, in the SPU, loopon velocity increase is directly proportional to increase in mass due to momenton absorption, it is proper that the square of k is retained. Therefore, the principle, $F = ma$, manifests itself in the SPU, with respect to Y interactions within loopons, as: $\Delta m_0 = .5m_0k^2$. Equation 18 arises when these two SPU expressions for mass are equated and solved for k.

$$\Delta m_o = 5m_o k^2 \ = \ .5m_o + m_p$$

$$k^2 \ = \ \frac{.5m_o + m_p}{.5m_o} = 1 + \frac{2m_p}{m_o}$$

$$k = \sqrt{1 + \frac{2m_p}{m_o}} \qquad \text{Eq. 18}$$

In this example, $k^2 = 1 + 12mg/15mg = 1.8$. Therefore, **k = 1.341640786**.

4.3 Conclusion

Nowhere in this analytic were relative frames of referenced used. What might be called: *Lorentz considerations* were necessary to explain the Michelson-Morley experiment. However, as I have just shown for the SPU, the Einstein-Lorentz equation for kinetic energy is valid with or without the presence of observers. It is ontologically valid. I suggest the same is true for our universe. In Equation 19 I give, from left to right, the hierarchy of principles that underwrite the Lorentz factor. Because SPU physics is, essentially, a Planck scale theory, the left formulation represents a relationship that can only be inferred by the model. Alternatively, the two to its right can be empirically affirmed.

$$\sqrt{1+\frac{2m_p}{m_o}\left(\frac{c-v}{c}\right)} = \sqrt{\frac{1+v/c}{1-v/c}\left(\frac{c-v}{c}\right)} = \sqrt{1-\frac{v^2}{c^2}} \qquad \text{Eq. 19}$$

A critical point is that, if one begins with the SPU formulation, one can derive the Lorentz factor using the SPU concept that mass changes drive velocity. However, if one begins with the Lorentz factor, one cannot reach the SPU formulation, unless one makes the causal assumption that velocity creates mass. In fact, this assumption is often used in the teaching of relativity theory. It is deeply tied to the assumption that matter, as something apart from space and time exists in our universe.

Since a photon cannot be matter in the sense of substance, some physicists have been tied to the assumption that a photon is a massless particle. But, upon this assumption, they are driven to the absurd conclusion that velocity creates matter as rest mass accelerates. Is it not simpler to conclude that mass-energy transubstantiation is created by the fact that both rest mass and photons are not fundamental but both composites of space and time relationships, e.g. t/d and d/t? When mass is defined as the relationship $t/d = \mu$ and velocity as $d/t = c$, it can be concluded then that neither velocity creates mass nor mass creates velocity but rather that both are created by how one particle, viz. μc, expresses itself.

I conclude that Equation 20 is a proper equation for kinetic energy in the SPU for those cases where one chooses to measure velocity in meters per second. Of course, if one prefers to set the standard for velocity at c = 1.000, then one need only use c instead of c^2.

$$E_k = \frac{m_o c^2}{\sqrt{1-\frac{v^2}{c^2}}} - m_o c^2 \qquad \text{Eq. 20}$$

5

Gravitation in the SPU

5.0 Overview

The simplicity of a physics with only one fundamental law, one kind of fundamental particle-antiparticle pair, two basic interactions, and only two basic kinds of composite particles has the advantage that its attractive and repulsive forces must be equally simple. For the SPU these forces can only express themselves through the fundamental principles found in the Y and V interactions.

This chapter explores the outcome of that case where a free directon is incident upon a momenton having an opposite character. Were it of the same character, the Y interaction would hold. But, what happens when a momenton encounters an oppositely charactered directon? How does the V interaction work between a free directon and an aggregate of directons where each is committed, not to its own direction but to a resultant direction?

The outcome belongs to a class of SPU outcomes I call YV interaction. The momenton to momenton exchange, shown in Sketch 2.5 on page 9, is, in a sense, a form of YV interaction since both are operative in the fragmenting and rebuilding of loopon momenton to maintain the temporal velocity. This chapter explains how another form of YV interaction creates gravitational attraction in the SPU.

5.1 SPU Gravitation as It Affects SPU Photons

Through sheer probability, directons will escape loopons. The primary source of these escapees is, in this model, best provided by the ongoing interaction between momentons within loopon loops, described in Sketch 2-5. That form of YV interaction would have a "cleansing" effect on momentons, purifying the character of each and bringing each to a point of statistical stability. If the basic, i.e. the simplest, loopon is also sized by statistical stability, momentons, in general, would tend to be trimmed as well.

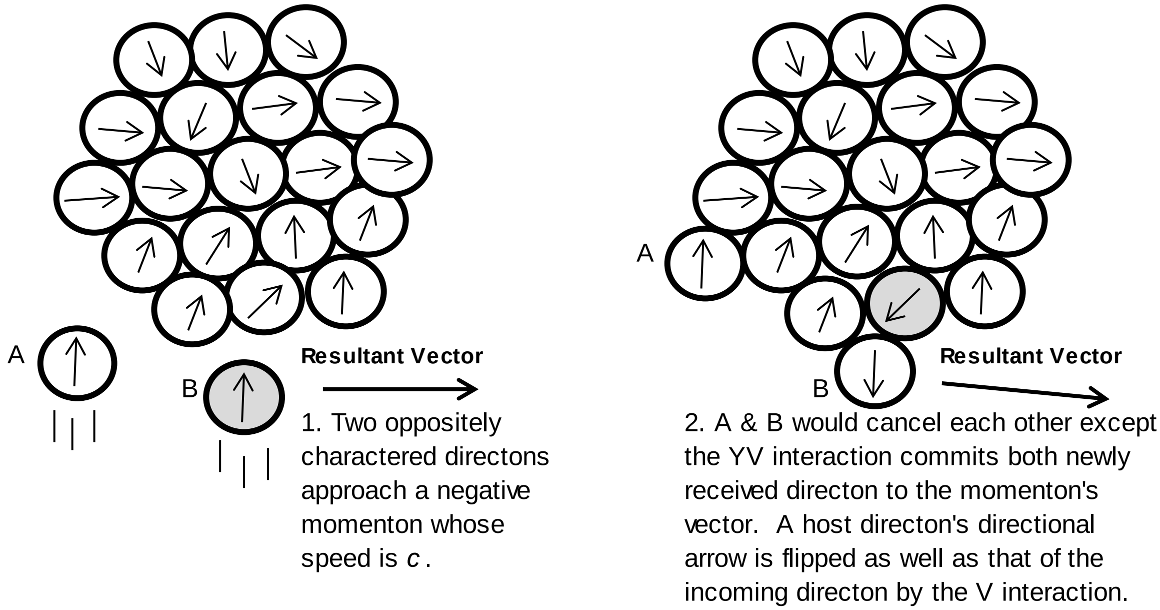
The likelihood of finding an escaped directon from a collection of loopons would, of course, be directly proportional to the size of the collection and inversely proportional to the square of the distance from it. These escaped directons will encounter momentons in two arrangements, loopons and photons. Both are structures of arranged momentons. Being the simpler structure, light is explored first.

Inter-galactic light is a good starting point because gravitational effects are minimal but free directons are still present. Momenton decay is necessary to the theory on long-distance photon alignment offered by Equation 9 on page 23. But, how does this decay take place?

Whether near a gravitating body or not, probability requires that, for every directon of like character received by a momenton (the Y interaction), it will receive one of opposite character. If from the same direction, each cancels the effect of the other as in the case of gravitation. Since a similar cancellation statistically takes place when incoming direction is random, the gravitational case is best used.

The V interaction is characterized by two oppositely polarized directons exchanging their polarity (temporal character). For every like directon entering a momenton traveling at the speed of c, an opposite directon also statistically enters. In this entering, it is forced to join the resultant direction (r) of its host momenton. In this capture, the opposite directon embeds both its temporal character and its vector in its host. Both its arrow and a host directon's arrow are flipped. Sketch 5-1 portrays this event.

Sketch 5-1



For explanation, the two-dimensional momenton in Sketch 5-1 will be used to calculate the effect on direction and velocity created by directons A and B. The effect on direction is considered first.

If a momenton's pre-incident resultant direction is set at 0^o, the angle of declination (φ) caused by the event described above is given by Equation 21 where m_V represents the number of opposite directons within a momenton, m_p represents the pre-incident count of majority directons, and θ represents the angle of incidence to *r*. In holding the assumption that, statistically, the decay-produced positive and negative directons of a gravitating body are equal in number, Equation 21 can only provide an outcome probability.

Because A and B, considered alone, cancel each other's directional effect on the momenton, only the arrow of the host's reversed directon has the ability to alter direction. Theta is set to the maximum 90^o in the above example to better demonstrate what might be called *underbelly bias*. The directons on the momenton side facing the gravitating source would be, on average, at an angle of + 45^o with respect to the momenton's direction of 0^o while those on the top half would be, on average, at an angle of -45^o. The V interaction will statistically provide the internal altered directon with a downward angle of -135^o. Statistically, all directons in a momenton can be divided into two collective camps: a top half pushing downward at 45^o and a bottom half pushing upward at 45^o. For every positive-negative directon pair striking momenton, one directon in the bottom half will be converted to a downward angle of -135^o. The net effect on the original population is -180^o for every opposite directon absorbed. The total of opposites absorbed is designated m_V and momenton mass increase is, as explained, statistically twice that. Equation 21 offers a starting point for understanding the effect of SPU gravitation on photons.

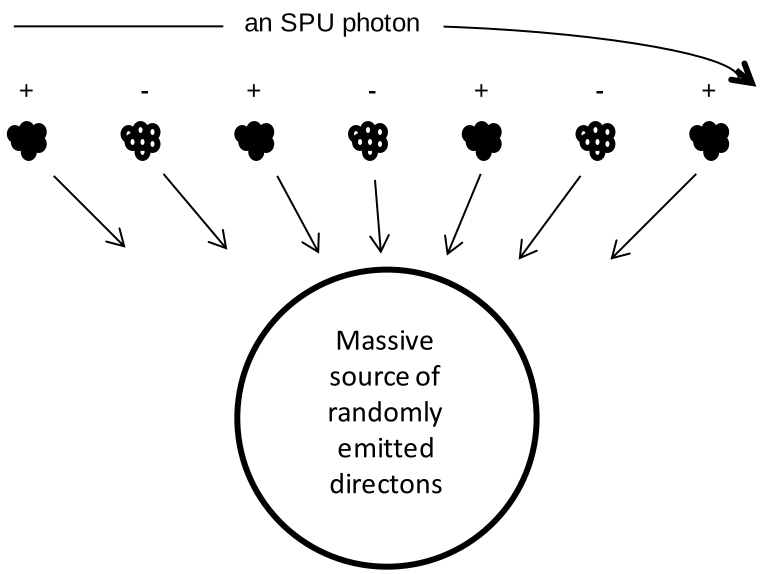
$$\varphi = \left[\frac{m_V(-180^o sine\theta)}{m_p + 2m_V}\right] \qquad \text{Eq. 21}$$

For Sketch 5-1, m_p is 19μ, m_V is1μ, and the sine of θ is 1.000. Accordingly, the post-incident angle of declination will be -8.5714^o. Note that as the sine of θ approaches zero, the angle of declination also approaches zero. However, as a photon in the SPU is enlarged by gravitation, its ability to impart momentum will not increase due to a redshift explained in Section 5-2.

A point of decay is reached when opposing temporal forces within a momenton grow to where they break apart its outer surfaces through a buildup of Y interaction pressure. An intergalactic SPU photon, as a train of positive and negative momentons, would be kept in alignment by the gravitational effects of Equation 21 as each momenton in the chain passes its excess directons to those behind it. In this way, as shown in Chapter Three, Section 3.6, SPU light redshifts in proportion to the distance traveled.

Sketch 5-2 shows a SPU Photon passing a gravitating body and the direction of influence upon each momenton by the gravitating body. These new directional influences, added to a photon's current vector, constantly redefine its directionality. In this way, SPU light is bent as it passes a gravitating body. Equation 21, extended over a SPU photon's full path creates SPU spacetime lines.

Sketch 5-2



As a photon passes a gravitating body it's straight alignment will be curved by changes in each momenton's resultant vector.

5.2 How SPU Gravitation Causes Light to Redshift

Sketch 5-1 portrays an example of the YV interaction, those defined by momentons made impure through V interactions. Though the entropy time of experience is unidirectional, directon time is bidirectional. Recall that *c* is the standard for the velocity of time in the SPU. Whether positive or negative, all directons must forever travel at the speed of *c* in their temporal character. However, the YV interaction in momentons forces directons having a temporal character, opposite that of their host momentons, to move in a time direction against its nature. Through what principle of fair reciprocity must the fundamental law of equal opposites express itself? Equation 22 answers this question.

$$\gamma_g = c - \left(\frac{m_V}{m_p + 2m_V}\right)c \qquad \text{Eq. 22}$$

Here, γ_g (γ_g < c) represents the resultant speed (*resultant temporal velocity*) of a bi-charactered momenton within a gravitational field. Since both the temporal momentum of the positive directon in Sketch 5-1 and that of all negative directons must be expressed and conserved, it can only be that the speed of the momenton must reflect both temporal arrows. For the example in Sketch 5-1, the momenton's resultant temporal velocity is .04762*c*.

5.3 SPU Gravitation as It Affects Loopons

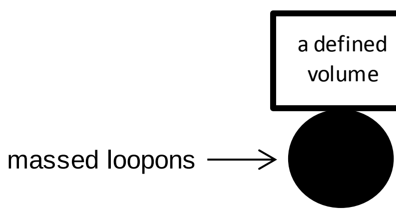
The basic gravitational principle affecting SPU photons is also operative for loopons since both are made of momentons and SPU gravitation is created by the YV directon-momenton relationship. Equation 22 is therefore operative for loopons, expressing itself, not as a redshift, but as time dilation. The two temporal characters in loopons move through each other at the momenton speed of *c*. But, because gravitation entangles these momentons with oppositely charactered directons, the loopon's spin speed is reduced, accordingly, through the statistical capture of downward directed arrows.

In the formation of loopons, momentons are linked in a constant state of exchange. This process, described in Sketch 2-5, essentially breaks apart and reassembles momenton structure, directon by directon. This model assumes this statistical process creates, generally, uniformity in momenton size, with a directon count likely in the billions.

As the positive and negative characters flow though each in opposite directions, the statistical "sifting" that results would sort momentons into like character through the Y interaction. All the while each momenton is trimmed as directons are able to statistically escape. These escaped directons contribute to the gravitational reach of larger structures of which a loopon is but a very tiny part.

Every mass in the SPU would statistically lose the same percentage of directons per given unit of time. Hence, the field density of escaped directons will be proportional to the rest mass of the gravitational source and inversely proportional to the square of distance of the measurement point from that source. Sketch 5-3 offers a local interpretation of this relationship.

Sketch 5-3



In the SPU, for any contiguous defined volume, the density of escaped directons within that volume will statistically be proportional to the size of the mass with which it is contiguous.

Once determined for a given measurement system, a SPU gravitational constant (*G*) would arise as a SPU universal constant because the probability of directon decay would tend toward a fixed value, due to the number of directons within every loopon. Essentially, it comes down to the fact that the probability of finding a free directon, from a given mass, in any given spatial volume would be directly proportional to the size of that mass and inversely proportional to the square of the volume's distance from that mass. In a reciprocal directon exchange between two masses, the likelihood of finding a free directon is altered by the product of the masses rather than the sum of the masses.

5.4 How Galileo's Law Can Be Derived From SPU Directional Change Ratios

Though momentons are the building blocks of photons and loopons, the mass ratio $m_V/(m_p+2m_V)$ is much less stable in loopons than in photons. The momenton to momenton exchange, shown in Sketch 2.5 on page 9, is absent in photons. In the former, momentons are cleansed through a slow decay process; in the latter, they are in an on-going process of deconstruction and reconstruction as the two positive and negative temporal forces move through the loops. The sifting process in loopons seeks to discard excess directons. These discarded directons are the source of its gravitational field. But, in this process of temporal cleansing, newly acquired direction directions are statistically retained. Therefore, loopons in a gravitational field do not experience mass increases.

With this background it can now be asked: What is the case for an object (large aggregate of loopons), locally at rest ($v = 0$) in a gravitational field, when instantly released from a state of support at point in time $t = 0$? For convenience, this analysis will utilize our temporal second and value for c.

Whereas γ_g represents the velocity of a SPU photon following a gravitationally induced mass change, let δ_g represent the velocity of a SPU loopon following a gravitationally induced mass change. Equation 23 provides the heuristic equation for such a change. Note this equation, unlike that for photons, must lack a mass increase, due to the loopon cleansing. For convenience, let the mass of each momenton in the loopon collection (physical object), prior to freefall, be 2.997925×10^8μ.

In Equation 22, the concern is with oppositely charactered directons (m_V). Here the concern is with like-charactered directons, within a momenton, whose downward directionality survived its loopon's momenton cleansing process. Let these directionally converted directons be designated m_δ. Upon release to freefall, let the number of these converted directons (m_δ), gravitationally created in each momenton per second, be 30, such that m_δ = 30μ. Since, statistically, every momenton in the loopon will be equally affected by the gravitational field, Equation 23 shows the approximate velocity of fall will be $1\times10^{-7}c$.

$$\Delta\delta_g = \left(\frac{m_\delta}{m_p}\right) c\ sec \qquad \text{Eq. 23}$$

This means, given the descriptive limits of Equation 23, the velocity increase (Δm_δ) of the object can be conveniently rounded to 30 meters per second at the end of the first second after release. During the next second, ignoring the change in proximity to the gravitating body, the thirty directons flipped by the gravitational V interaction will be joined by another 30, and so on, as shown below, for each second thereafter until the released collection is violently returned to a state of rest upon landing. The notation is familiar; $\bar{v}$ is average velocity during each one second time interval. Each interval has its beginning velocity designated as v_1 and ending velocity as v_2. The letter s represents total distance traveled.

<u>At the end of second 1</u>: $\delta_g = (30p/2.997925\times10^8 p)\ (2.997925\times10^8 m/sec) = 30 m/sec$

$\bar{v} = (v_1 + v_2)/2 = (0 + 30m/sec)/2 = 15m/sec.$ $\quad at = v_2 - v_1 = 30m/sec\ \ (a = 30m/sec)$

$s = \bar{v}t = 15m/sec \times 1\ sec = .5at^2 = 15m.$

<u>At the end of second 2</u>: $\delta_g = (60p/2.997925\times10^8 p)\ (2.997925\times10^8 m/sec) = 60 m/sec$

$\bar{v} = (v_1 + v_2)/2 = (0 + 60m/sec)/2 = 30m/sec.$ $\quad at = v_2 - v_1 = 60m/sec\ \ (a = 30m/sec)$

$s = \bar{v}t = 30m/sec \times 2\ sec = .5at^2 = 60m.$

<u>At the end of second 3</u>: $\delta_g = (90p/2.997925\times10^8 p)\ (2.997925\times10^8 m/sec) = 90 m/sec$

$\bar{v} = (v_1 + v_2)/2 = (0 + 90m/sec)/2 = 45m/sec.$ $\quad at = v_2 - v_1 = 90m/sec\ \ (a = 30m/sec)$

$s = \bar{v}t = 45m/sec \times 3\ sec = .5at^2 = 135m.$

<u>At the end of second 4</u>: $\delta_g = (120p/2.997925\times10^8 p)\ (2.997925\times10^8 m/sec) = 120 m/sec$

$\bar{v} = (v_1 + v_2)/2 = (0 + 120m/sec)/2 = 60m/sec.$ $\quad at = v_2 - v_1 = 120m/sec\ \ (a = 30m/sec)$

$s = \bar{v}t = 60m/sec \times 4\ sec = .5at^2 = 240m.$

Since
$$v_2 = at + v_1 \qquad \text{Eq. 24}$$

Then
$$\bar{v} = \left(\frac{2v_1 + at}{2}\right) \qquad \text{Eq. 25}$$

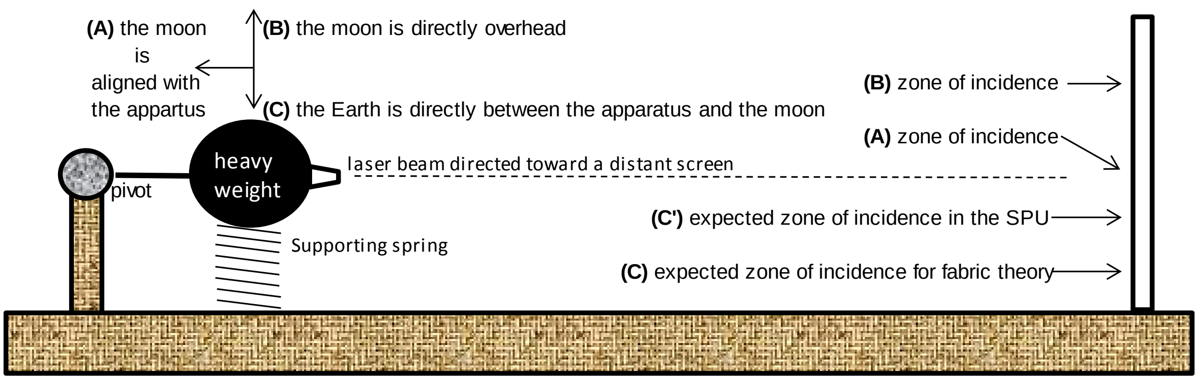
Therefore
$$d = \left(\frac{2v_1 + at}{2}\right) t = v_1 t + \frac{1}{2} a t^2 \qquad \text{Eq. 26}$$

5.5 How to Test for a Particle Interpretation of Gravity "Waves"

When one body orbits another cyclical gravitational fluctuations arise. When space is perceived to be, ontologically, a continuous spacetime "fabric" warped by the presence of matter; these fluctuations are best described by wave equations in the Huygens tradition. The particle interpretation of gravitation offered here stands outside that tradition.

Sketch 5-4 portrays a simple apparatus that can either support or debunk the possibility that our gravitation is, at its base, particle driven as opposed to fabric driven.

Sketch 5-4



In the conventionally accepted interpretation of gravitation, there is no allowance for the absorption of directon-like particles. If our Planck scale is defined by momenton-like particles, the SPU's directons would belong to a sub-Planck scale. Thus, this experiment can only go to larger question: Is gravitation caused by an exchange of particles between attracting masses?

The experiment's initial state (A) calls for the measurement of a spring-supported weight, as it is at a point of indifference to the gravitational influence of the moon upon the Earth. Due to the experiment's required sensitivity, it is suggested the experiment be done using a pivot and laser beam with the beam directed toward a distant screen. With the moon directly overhead (state B), the moon's gravitational influence will slightly lift the weight causing the laser beam to be incident to the screen in zone B.

A mean-center calculation must be used due to the influence of seismic and other vibrational sources. The mean-center between zone A and B can be used to calculate the expected location on the screen of zone C, that area of the screen where the laser beam (created by Y interactions in the SPU) should be incident when the moon and the Earth align such that both pull the weight against its supporting spring. A particle interpretation of gravitation will suggest that the finding of the experiment will be that the actual outcome of the experiment will place the incident beam at zone C' due to the absorption of moon-emitted gravitational particles by the Earth.

In the SPU, the effect of gravity only occurs to the degree that the affected body absorbs free directons. The same would be the case for any cosmology assuming particle driven gravitation. In a particle interpretation of gravitation, the gravitational "waves" created by distant galaxies owe their origin to the effects of particle absorption.

6

The CH74 Bell Test in the SPU

6.0 Overview

Recognizing that SPU physics is essentially an interpretation of the quantum, one might ask: What if our universe is the SPU? To even begin such an investigation, the SPU interpretation of the photon must deal with the challenge to locality created by Bell's Theorem and the CH74 experiment. What would happen if the CH74 experiment was taken from our universe and placed in the SPU?

The Aspect experiments had this experiment as their core with the addition of instruments designed to prove that the two photons involved in each trial were not communicating with each other.[1] Aspect proved this concern to be meaningless. But no one addressed a deeper question: What happens when the photon on the A side of the experiment is observed before the photon on the B side of the experiment reaches the double-slit wall of an interference device like that built by Taylor?

If the two wave functions are truly entangled as one, as the application of Bell's theorem suggests, then, given the standard interpretation's belief the observation of a wave function collapses all probabilities, the observation of photon A, before photon B reaches the double slits, can only mean that photon B has also lost its wave function. Therefore, it will be incapable of producing equally spaced interference bands. The absence of these bands would serve as proof that the wave function was truly entangled before photon A was observed.

However, the Achilles' heel of Bell's theorem in the SPU is its assumption that electrons and photons are indivisible and that delayed absorption and reemission factors (what I call the popcorn effect) play no role in experimental outcomes. SPU physics deconstructs this assumption. In doing so, it finds the CH74 experiment's much-touted cosine square relationship to be nothing more than a natural outcome of gathered momenton absorption reaching that point needed to eject an electron (see table 6-1).

Therefore, in the SPU, the collapse of the wave function on the A side through observation will have no effect on the B side; the B photon will continue on to the screen with all its wave properties intact. Its structure is that of a spray of alternating momentons that creates interference patterns through Y and V interactions. This structure is entirely local.

6.1 The Clauser-Horne Device and its Predicted Outcome

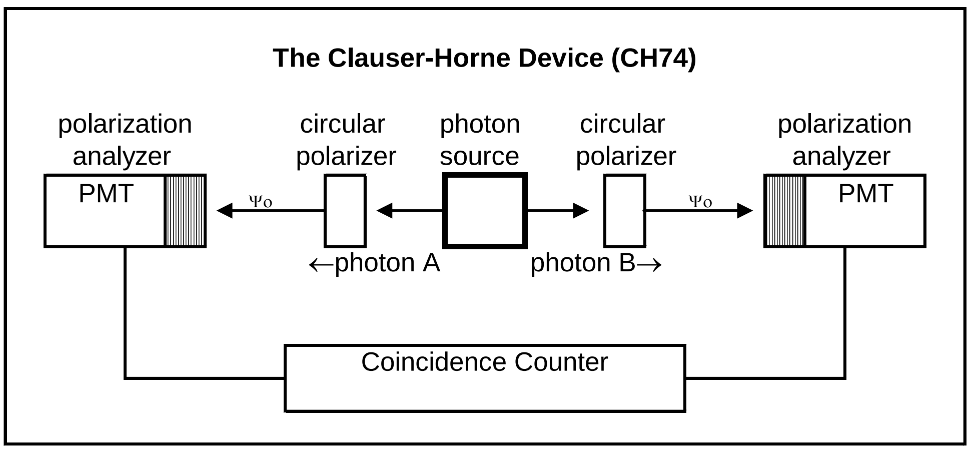
In 1964 John S. Bell discovered an inequality, in the coincidence predictions between EPR and the standard interpretation of quantum theory, having the ability to resolve the EPR debate. In doing so, he paved the way for a series of experiments that now bear his name.

In creating his theorem, Bell compared the quantum mechanical "singlet state for combined subspaces" with classical "separable predetermination" for two particles obedient to the need to conserve spin states.[2] In making this comparison he did not use polarization states specifically; but photons serve quite well to confirm his predicted outcome; if and only if one assumes a photon is not granular and is absorbed in a way apart from the absorption and reemission table offered here. The first "Bell test" using polarization states was proposed in 1969 by John Clauser, Michael Horne, Abner Shimony, and Richard Holt.[3] The CH74 experiment is the product of that proposal. Today, the quantum mechanical "singlet state for combined subspaces" is popularly called "entanglement."

The way in which light can be used to demonstrate Bell's predicted inequality is best grasped by examining the outcome expectations held by quantum physics when two simultaneously emitted circularly polarized photons, each identically aligned with a common axis of propagation, are sent to opposing polarization analyzers. To test two photons, paired in this way, Clauser and Horne designed their 1974 experiment outlined in Sketch 6-1. The experiment begins by exciting atoms that, in turn, release two distinct photons. (I will argue the claim can only be: two distinct PMT registrations.) In Aspect's version of the device, energized calcium atoms are used to create a blue photon at a wavelength of 422.7 nm and a green photon at a wavelength of 551.3 nm.[4]

Both photons are circularly polarized such that their vertical harmonics have common planes on their two aligned paths of propagation. That is, both rotate like aligned spokes on the two wheels of a fixed-axle cart. Additionally, they are merged, through the mechanics of phase quadrature into a common wave function placing both photons in the same circular polarization state (Ψ_o). This "superpositioned" polarization state is the photon version of Bell's quantum mechanical "singlet state for combined subspaces," the common factor that makes the photons "entangled."

Sketch 6-1



The Clauser-Horne (CH74) device produces a single rule for entangled photons. This rule is first seen when the two polarization analyzers are perfectly aligned, that is, when the difference in their transmission axes is zero. When one photon passes, the other always passes.

It does not matter what the common angle is with respect to the wave function's aligned path of propagation; when one photon passes the other still passes.[5] Theta (θ), the angle between the two transmission axes of the two analyzers, is to be distinguished from the angle between a linearly polarized photon's plane of propagation and the transmission axis of its assigned polarization analyzer (ϕ). The following rule holds for all values of theta where P represents the probability a coincidence will occur.

$$P_{CH74} = cos^2\theta \qquad \text{Eq. 27}$$

A linearly polarized photon has a 100% chance of passing through an analyzer when it is perfectly aligned with its transmission axis. However, it has a 0% probability of passing through an analyzer when it is perpendicular to its transmission axis. Since a circularly polarized photon, having phase quadrature, contains both the linearly polarized vertical state and the linearly polarized horizontal state, classical reasoning would argue the other photon could be blocked just as easily as it could be passed. Hence, the classical expectation is that when one photon passes, the other will only have a 50/50 chance of passing.

Equation 27 is claimed also when the two analyzers are set at 90º to each other. When one passes, the other has a 0% probability of passing. The quantum theoretic outcomes provided by the CH74 Bell test can be stated as a simple rule: **No matter what the angle between the two CH74 analyzers, when one photon passes, the probability the other will pass is equal to the square of the cosine of the angle between the analyzers (θ).**[6] There is no classical model for a photon which can produce these results. Using presently accepted theories, the experiment produces no "*locality*." It is now popularly believed that a single wave function operating across the domain of the experiment is the acceptable explanation.

Were the CH74 apparatus transported to the SPU and the opposing polarizers set at 90º, the coincidence outcome would not be 0.00000 as predicted by the standard interpretation but would be .00555. This predicted outcome can be used to test whether or not our universe is the SPU.

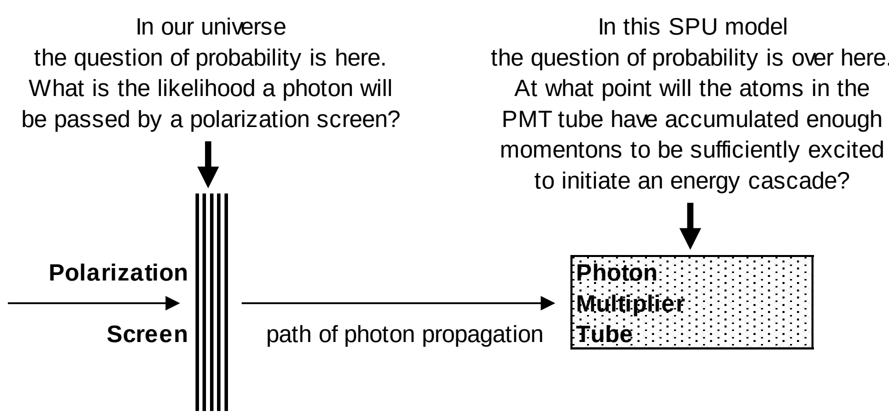
6.2 The SPU PMT Tubes and the "Popcorn Effect"

The entirety of both the EPR debate and our interpretations of Bell tests have been carried out upon the assumption that light is not granular. In this model, the atoms in a SPU PMT receiver work more like kernels of popcorn in a microwave oven. Individual momentons are repeatedly absorbed until a point of instability is reached which causes a super loopon (e.g. our electron) to eject. However, just as kernels of popcorn exposed to the same source of radiation, do not all explode at the same moment, the same would be true for the complex loopon structures in a SPU PMT. Yet, I cannot say how many SPU momentons have to be absorbed before the super loopons, which form the bricks of the atomic structure of the SPU PMT's receiving screen, become unstable enough to release the momentons, likely in the form of new photons, needed to initiate the discharge of even one SPU electron.

Table 6-1 assumes an electron ejection takes place when 1.0000 energy units are absorbed by the SPU PMT. This equates to that point at which the work function resistance is overcome. Within each cycle of a SPU photon is a spray of alternating momentons comprised of one positive field followed by a negative field at 90º to it. The 360 cycles given in Table 6-1 (p.46) replaces Equation 27 with Equation 28.

$$P_{SPU} = cos^2\theta + .00555\frac{\theta}{90^o} \qquad \text{Eq. 28}$$

Sketch 6-2



6.3 Polarization and the SPU Photon

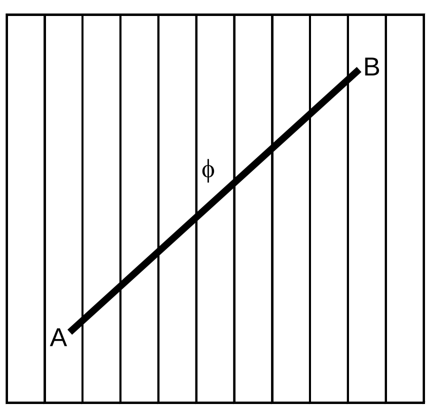
Hidden within the bowels of the CH74 experiment is the structure of the photon. This ultimately determines the nature of circular polarization having phase quadrature. Therefore a few comments on light propagation are in order for readers unfamiliar with the concept. Wave propagation begins with a point-source for the waves, e.g. a stick rapidly stirred in water. The stick is properly called an *oscillator* and an imaginary line from the stick to, say a floating object, the *path of propagation*. The vibration direction of the floating object is always perpendicular to the path of propagation. Were the water in this metaphor invisible, one could still know the plane of the pool, the amplitude of each wave and the frequency of each wave simply by observing the vibration exhibited by the floating object.

In the case of light, an emitter provides a photon with its frequency and amplitude and a polarizer serves to create a plane of vibration for a photon's "wave," i.e. its polarized state. If that plane is consistently perpendicular to a point of reference, the photon is said to be linearly polarized. A sheet of polarizing film placed in the path of propagation of a linearly polarized photon and in front of a photon detector (PMT for photon multiplier tube) serves to reveal the photon's polarized state, i.e. its *plane of propagation*. The combination of a rotatable sheet of polarizing film and PMT is called a *polarization analyzer*.

For purposes of conceptualization only, a polarizing film sheet can be compared to the strings of a harp and a photon's polarization plane to a thin disk. The disk can be inserted through the strings of the harp, when parallel to those strings, and cannot be when the disk is perpendicular to those strings. The molecular "alignment of strings" in a sheet of polarizing film is called the film's *transmission axis*. Experimentation has repeatedly verified that, when a linearly polarized photon is incident upon a sheet of polarizing film, the probability the photon will reach a PMT directly behind that film is equal to the square of the cosine of the angle formed by the photon's wave plane and the transmission axis of the polarizing film. Since the cosine of 0^o is 1.000 and the cosine of 90^o is 0.000, the harp analogy holds for these two angles.

Sketch 6-3

The Propagation plane of a Lineraly Polarized Photon Imposed on a Polarization Analyzer



Where the line AB represents a linearly polarized photon's plane of propagation, the vertical grid represents the polarization analyzer's transmission axis, and ϕ represents the angle between the two, the probability (P) that the photon will be passed by the analyzer is:

$$P = \cos^2 \phi$$

Yet, the harp analogy is not too helpful in understanding the probabilities for interim angles. For example, for a linearly polarized photon incident upon a polarizing film at an angle of 45^o, the probability that it will reach a targeted PMT behind the film is one-half.

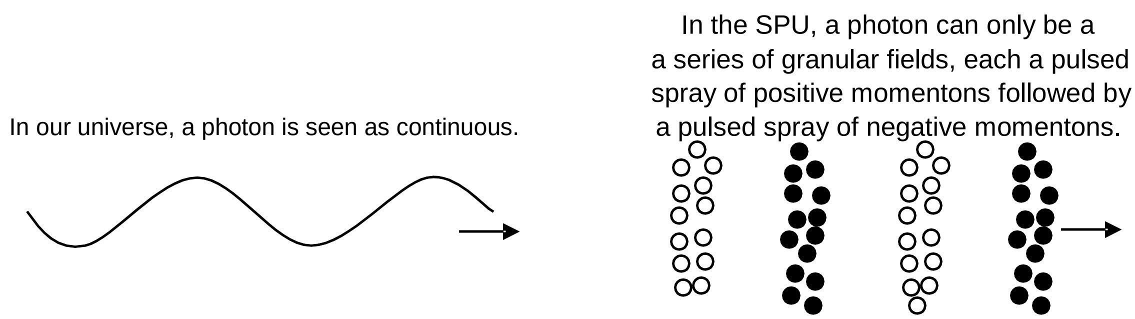
The probabilities become even more complex where circular polarization is involved. Circular polarizers are commonly used in cameras to bring clarity to images and deepen the blue of the sky. Physics professors sometimes use the metaphor of a long rope tied to a wall to explain the difference between linear polarization and circular polarization. Vertical linear polarization is analogous to whipping the rope up and down, sending waves toward the wall. Horizontal linear polarization is analogous to whipping the rope sideways. Circular polarization is compared to circularly swirling the rope to create spirals moving toward the wall.

In optics, circular polarization is obtained by combining a vertical polarizing lens with a "quarter-wave" plate to create a state where a light wave's plane of propagation rotates as the photon traverses its path of propagation. If this rotation is clockwise, as the photon moves toward an observer, the photon is said to be *right polarized*. If it is counterclockwise it is said to be *left polarized.*

Through rotation, a circularly polarized photon's plane of propagation can hold any angle with respect to a polarization analyzer. For this reason, an analyzer, facing circularly polarized light, can be rotated to reveal the same energy readings at every angle of orientation.[7]

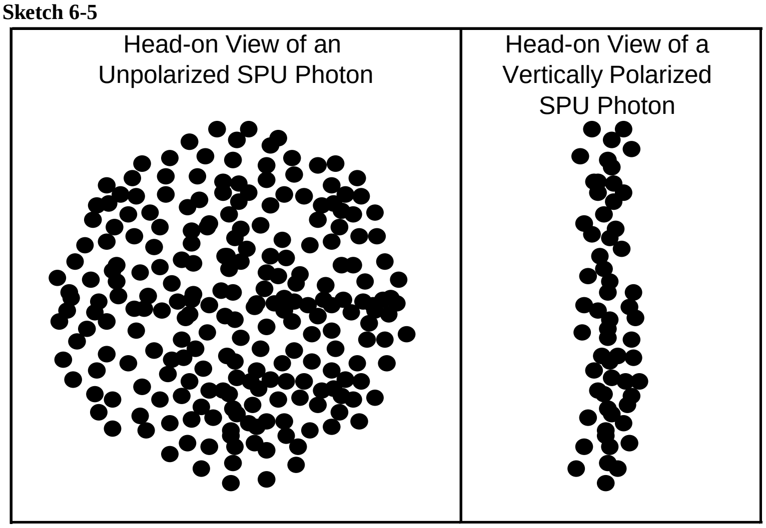
Sketch 6-4 shows the conceptual difference between our photon and a SPU photon. Because our photons are not divisible, our interpretation of absorption assumes the entire photon is instantly imparted to its receiving material. In the case of a polarization filter, it is assumed the same nominal (ontologically existing) "photon" which entered the polarizer is the same as that which emerges.

Sketch 6-4



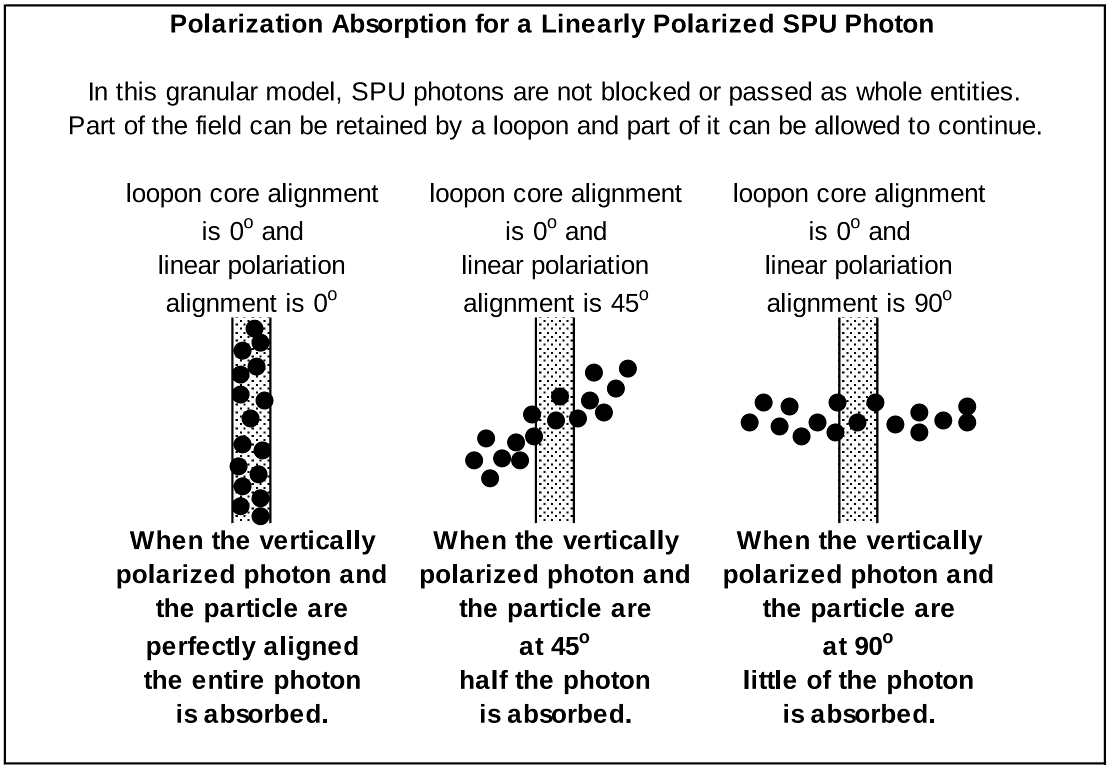
Sketch 6.5 portrays the oncoming "views" of the positive field of an unpolarized SPU photon and a linearly polarized SPU photon. The number and density are only shown conceptually.

Sketch 6-5



In the SPU, it must be recognized that everything, including the polarizing films and the PMT tubes, can only be made of momentons, loopons, and super loopons; and all of these are made of directons. Therefore, to truly transport the CH74 device to the SPU, I will assume that the receiving screens of the SPU PMTs are made with two kinds of very different super loopons; a positive one having a mass 1,836 times larger than the negative one. Sketch 6-6 portrays linear SPU photon absorption for a loopon core. It assumes all of the loopons or super loopons in the filter are similarly aligned.

Sketch 6-6

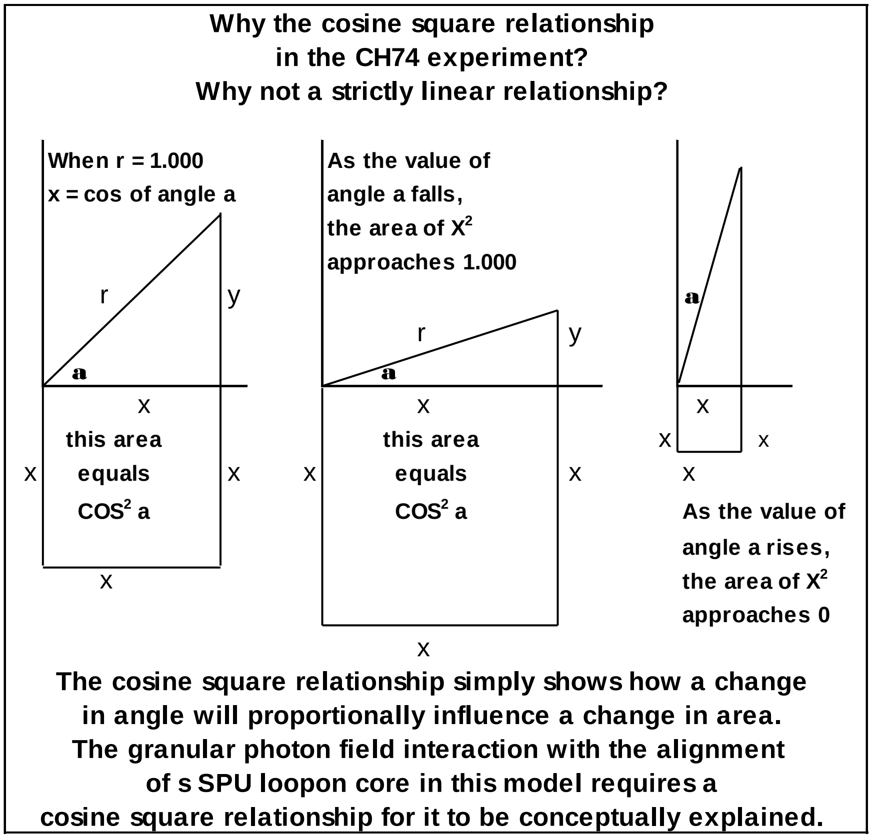


Sketch 6-6 reveals that at 90° some of the momenton field is retained. In this model, I am assuming that a SPU polarizing film's transmission axis is perpendicular to a systemic orthonormal alignment of the loopon cores within the positive and negative super loopons comprising the atomic structure of the filter. Neutral SPU particles within the atomic structure are ignored. I believe this slight retention is behind the outcome projections within Table 6-1.

6.4 Why the Cosine Square Relationship Exists in the CH74 Experiment

Sketch 6-6 idealizes how a change in photon angle affects its exposed area to a loopon core. Sketch 6-7 reveals that such a relationship is properly described by a cosine square table, not by a percentage table, though the two will overlap at 0°, 45°, and 90°. In the SPU, there is nothing spectacular about the cosine square relationship for polarization; it merely reflects the relationship between a change in the absorbed area of a photon's granular field and a change in φ, the angle between the orthonormal alignment of the loopons in a SPU polarization filter and the alignment of the linearly polarized momenton fields. Therefore, **for a linearly polarized SPU momenton field, positive or negative, the portion of the field that will be passed by a polarized filter will proportionally change with the square of the cosine of the angle (φ) between the alignment of the momenton field and the analyzer's transmission axis.**

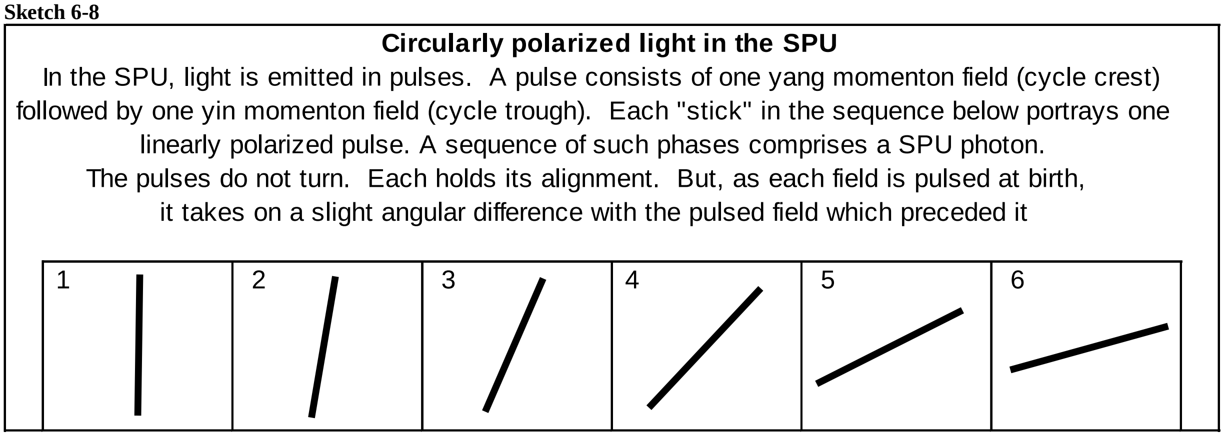
Sketch 6-7



6.5 Circular Polarization and Phase Quadrature in the SPU

Our circularly polarized light propagates like a continuously twisting sine wave. Alternatively, in the SPU, light is emitted in pulses and propagates accordingly. Therefore, a circularly polarized SPU photon will not propagate like a continuously twisting sine wave, but more like a continuously twisting parade of non-contiguous granular fields, each at a slightly different angle from the alignment of the field preceding it. For both, the "crest" and "trough" of each cycle are at right angles to each other. To distinguish between a positive field of momentons (wave cycle crest) and its following negative field (wave cycle trough), the former will be called the yang field and the latter the yin field.

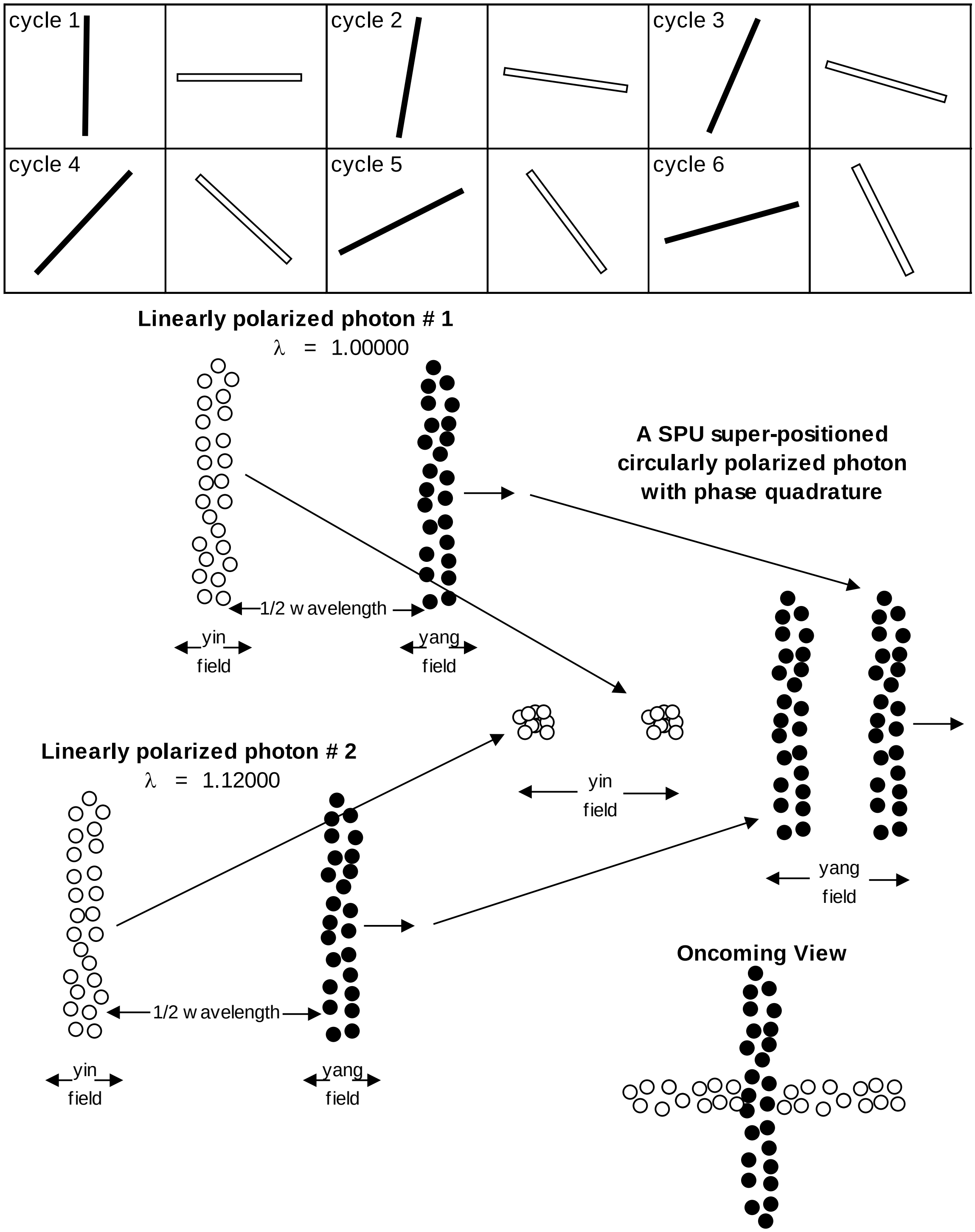
Sketch 6-8



Sketch 6-9

Super-positioned Phase Quadrature in the SPU

A full rotation in the SPU is that sequence of circularly polarized field pulses defined by one full (360^{o}) rotation. Phase quadrature, given the nature of SPU light, can only be a specialized case for circularly polarized light where the yin field is at a right angle to the yang field, or vice-versa.



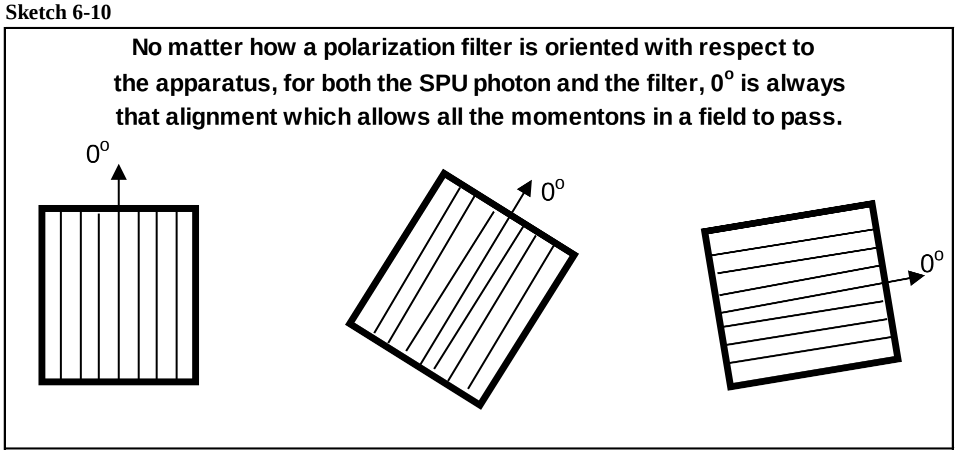
Sketch 6-8 portrays the idea of pulsed rotation in a clockwise manner. The CH74 device requires that both polarization analyzers "see" the same direction of rotation. The experiment further requires that its light exhibit phase quadrature. In this model, the equivalent effect can only be achieved by having the yin field (negative momenton cycle field) follow the yang field (positive momenton cycle field) at a right angle. Sketch 6-9 portrays the pulsed rotation of phase quadrature in a clockwise manner.

In the SPU, a single cycle for a SPU super-positioned circularly polarized photon is a marriage of two initially separate cycles, called here a yang cycle followed by a yin. Though it is properly said one SPU super-positioned cycle has two linearly polarized yang fields followed by two linearly polarized yin fields, the model is simplified and the outcome unaffected by treating each pair of like-charactered fields as one field. Sketch 6-9 also captures my interpretation of phase quadrature in the SPU.

6.6 Table 6-1 and Equation 28

The SPU phase quadrature absorption and re-emission track is built into Table 6-1. It provides my interpretation of the CH74 outcomes for that case where polarization filter B is set at 90º from the angle held by filter A. The angle of the transmission axis of filter A is always, in my tables, given as 0º. What that angle might be, relative to any outside frame of reference, is irrelevant. For convenience, the table assumes 360 cycles in each rotation. The outcome is not changed if an actual full rotation of circularly polarized light has more or less than that number.

Sketch 6-10



As said earlier, Table 6-1 assumes an electron ejection takes place when 1.0000 energy units are absorbed by the SPU PMT. This equates to that point at which the work function resistance is overcome. Within each cycle of a SPU photon is a spray of alternating momentons comprised of one yang field followed by a yin field at 90º to it. There are 360 cycles given in Table 6-1. If our universe is the SPU, repeated runs of the CH74 device will tend toward the probability given in Equation 28.

$$P_{SPU} = cos^2\theta + .00555\frac{\theta}{90^o} \quad \text{(Eq. 28)}$$

A cursory review of this table suggests that its symmetry would require the 50-50 outcome predicted by classical thought. However, the SPU imbalance is created by the fact that the positive-negative momentum balance in each photon cycle is not matched inertially by the mass imbalance of protons with respect to electrons. The bullets are all the same size, but, since electron ejection is needed for a registration to be recorded, yin interactions push electrons differently than yang interactions. Yang Y interaction hits on protons greatly lack the effect of yin Y interaction hits on electrons.

Table 6-1

SPU

PMT Momenton Absorption and Loopon Instability Schedule

Assuming Particle Ejection at Peak of Instability

where, with respect to the CH74 device,

filter A is set to X^o and filter B is set to (X + 90)^o

Phi is the angle between the alignment of each field

and the alignment of the transmission axis of its polarization filter

Cycle 1 occurs when phi equals zero for the yang field alignment at polarization filter A

Cycle	FILTER A yang field ϕ	FILTER A yin field ϕ	PMT A acquired yang	PMT A acquired yin	PMT A yang internal emission	PMT A yin internal emission	PMT A net yang unemitted	PMT A net yin unemitted	Cycle	FILTER B yang field ϕ	FILTER B yin field ϕ	PMT B acquired yang	PMT B acquired yin	PMT B yang internal emission	PMT B yin internal emission	PMT B yang instability	PMT B yin instability
1	0	90	1.00000	0.00000	1.00000		0.00000	0.00000	1	90	0	0.00000	1.00000		1.00000	0.00000	0.00000
2	1	91	0.99970	0.00030			0.99970	0.00030	2	91	1	0.00030	0.99970			0.00030	0.99970
3	2	92	0.99878	0.00122	1.00000		0.99848	0.00152	3	92	2	0.00122	0.99878		1.00000	0.00152	0.99848
4	3	93	0.99726	0.00274	1.00000		0.99574	0.00426	4	93	3	0.00274	0.99726		1.00000	0.00426	0.99574
5	4	94	0.99513	0.00487	1.00000		0.99087	0.00913	5	94	4	0.00487	0.99513		1.00000	0.00913	0.99087
6	5	95	0.99240	0.00760	1.00000		0.98328	0.01672	6	95	5	0.00760	0.99240		1.00000	0.01672	0.98328
7	6	96	0.98907	0.01093	1.00000		0.97235	0.02765	7	96	6	0.01093	0.98907		1.00000	0.02765	0.97235
8	7	97	0.98515	0.01485	1.00000		0.95750	0.04250	8	97	7	0.01485	0.98515		1.00000	0.04250	0.95750
9	8	98	0.98063	0.01937	1.00000		0.93813	0.06187	9	98	8	0.01937	0.98063		1.00000	0.06187	0.93813
10	9	99	0.97553	0.02447	1.00000		0.91366	0.08634	10	99	9	0.02447	0.97553		1.00000	0.08634	0.91366
11	10	100	0.96985	0.03015	1.00000		0.88350	0.11650	11	100	10	0.03015	0.96985		1.00000	0.11650	0.88350
12	11	101	0.96359	0.03641	1.00000		0.84710	0.15290	12	101	11	0.03641	0.96359		1.00000	0.15290	0.84710
13	12	102	0.95677	0.04323	1.00000		0.80387	0.19613	13	102	12	0.04323	0.95677		1.00000	0.19613	0.80387
14	13	103	0.94940	0.05060	1.00000		0.75327	0.24673	14	103	13	0.05060	0.94940		1.00000	0.24673	0.75327
15	14	104	0.94147	0.05853	1.00000		0.69474	0.30526	15	104	14	0.05853	0.94147		1.00000	0.30526	0.69474
16	15	105	0.93301	0.06699	1.00000		0.62775	0.37225	16	105	15	0.06699	0.93301		1.00000	0.37225	0.62775
17	16	106	0.92402	0.07598	1.00000		0.55178	0.44822	17	106	16	0.07598	0.92402		1.00000	0.44822	0.55178
18	17	107	0.91452	0.08548	1.00000		0.46629	0.53371	18	107	17	0.08548	0.91452		1.00000	0.53371	0.46629
19	18	108	0.90451	0.09549	1.00000		0.37080	0.62920	19	108	18	0.09549	0.90451		1.00000	0.62920	0.37080
20	19	109	0.89401	0.10599	1.00000		0.26481	0.73519	20	109	19	0.10599	0.89401		1.00000	0.73519	0.26481
21	20	110	0.88302	0.11698	1.00000		0.14783	0.85217	21	110	20	0.11698	0.88302		1.00000	0.85217	0.14783
22	21	111	0.87157	0.12843	1.00000		0.01940	0.98060	22	111	21	0.12843	0.87157		1.00000	0.98060	0.01940
23	22	112	0.85967	0.14033		1.00000	0.87907	0.12093	23	112	22	0.14033	0.85967	1.00000		0.12093	0.87907
24	23	113	0.84733	0.15267	1.00000		0.72640	0.27360	24	113	23	0.15267	0.84733		1.00000	0.27360	0.72640
25	24	114	0.83457	0.16543	1.00000		0.56097	0.43903	25	114	24	0.16543	0.83457		1.00000	0.43903	0.56097
26	25	115	0.82139	0.17861	1.00000		0.38236	0.61764	26	115	25	0.17861	0.82139		1.00000	0.61764	0.38236
27	26	116	0.80783	0.19217	1.00000		0.19019	0.80981	27	116	26	0.19217	0.80783		1.00000	0.80981	0.19019
28	27	117	0.79389	0.20611		1.00000	0.98408	0.01592	28	117	27	0.20611	0.79389	1.00000		0.01592	0.98408
29	28	118	0.77960	0.22040	1.00000		0.76368	0.23632	29	118	28	0.22040	0.77960		1.00000	0.23632	0.76368
30	29	119	0.76496	0.23504	1.00000		0.52864	0.47136	30	119	29	0.23504	0.76496		1.00000	0.47136	0.52864
31	30	120	0.75000	0.25000	1.00000		0.27864	0.72136	31	120	30	0.25000	0.75000		1.00000	0.72136	0.27864
32	31	121	0.73474	0.26526	1.00000		0.01338	0.98662	32	121	31	0.26526	0.73474		1.00000	0.98662	0.01338
33	32	122	0.71919	0.28081		1.00000	0.73256	0.26744	33	122	32	0.28081	0.71919	1.00000		0.26744	0.73256
34	33	123	0.70337	0.29663	1.00000		0.43593	0.56407	34	123	33	0.29663	0.70337		1.00000	0.56407	0.43593
35	34	124	0.68730	0.31270	1.00000		0.12323	0.87677	35	124	34	0.31270	0.68730		1.00000	0.87677	0.12323
36	35	125	0.67101	0.32899		1.00000	0.79424	0.20576	36	125	35	0.32899	0.67101	1.00000		0.20576	0.79424
37	36	126	0.65451	0.34549	1.00000		0.44875	0.55125	37	126	36	0.34549	0.65451		1.00000	0.55125	0.44875
38	37	127	0.63782	0.36218	1.00000		0.08657	0.91343	38	127	37	0.36218	0.63782		1.00000	0.91343	0.08657
39	38	128	0.62096	0.37904		1.00000	0.70753	0.29247	39	128	38	0.37904	0.62096	1.00000		0.29247	0.70753
40	39	129	0.60396	0.39604	1.00000		0.31149	0.68851	40	129	39	0.39604	0.60396		1.00000	0.68851	0.31149
41	40	130	0.58682	0.41318		1.00000	0.89831	0.10169	41	130	40	0.41318	0.58682	1.00000		0.10169	0.89831
42	41	131	0.56959	0.43041	1.00000		0.46790	0.53210	42	131	41	0.43041	0.56959		1.00000	0.53210	0.46790
43	42	132	0.55226	0.44774	1.00000		0.02016	0.97984	43	132	42	0.44774	0.55226		1.00000	0.97984	0.02016
44	43	133	0.53488	0.46512		1.00000	0.55504	0.44496	44	133	43	0.46512	0.53488	1.00000		0.44496	0.55504
45	44	134	0.51745	0.48255	1.00000		0.07249	0.92751	45	134	44	0.48255	0.51745		1.00000	0.92751	0.07249
46	45	135	0.50000	0.50000		1.00000	0.57249	0.42751	46	135	45	0.50000	0.50000	1.00000		0.42751	0.57249
47	46	136	0.48255	0.51745	1.00000		0.05504	0.94496	47	136	46	0.51745	0.48255		1.00000	0.94496	0.05504
48	47	137	0.46512	0.53488		1.00000	0.52016	0.47984	48	137	47	0.53488	0.46512	1.00000		0.47984	0.52016
49	48	138	0.44774	0.55226		1.00000	0.96790	0.03210	49	138	48	0.55226	0.44774	1.00000		0.03210	0.96790
50	49	139	0.43041	0.56959	1.00000		0.39831	0.60169	50	139	49	0.56959	0.43041		1.00000	0.60169	0.39831
51	50	140	0.41318	0.58682		1.00000	0.81149	0.18851	51	140	50	0.58682	0.41318	1.00000		0.18851	0.81149
52	51	141	0.39604	0.60396	1.00000		0.20753	0.79247	52	141	51	0.60396	0.39604		1.00000	0.79247	0.20753
53	52	142	0.37904	0.62096		1.00000	0.58657	0.41343	53	142	52	0.62096	0.37904	1.00000		0.41343	0.58657
54	53	143	0.36218	0.63782		1.00000	0.94875	0.05125	54	143	53	0.63782	0.36218	1.00000		0.05125	0.94875
55	54	144	0.34549	0.65451	1.00000		0.29424	0.70576	55	144	54	0.65451	0.34549		1.00000	0.70576	0.29424
56	55	145	0.32899	0.67101		1.00000	0.62323	0.37677	56	145	55	0.67101	0.32899	1.00000		0.37677	0.62323
57	56	146	0.31270	0.68730		1.00000	0.93593	0.06407	57	146	56	0.68730	0.31270	1.00000		0.06407	0.93593
58	57	147	0.29663	0.70337	1.00000		0.23256	0.76744	58	147	57	0.70337	0.29663		1.00000	0.76744	0.23256
59	58	148	0.28081	0.71919		1.00000	0.51338	0.48662	59	148	58	0.71919	0.28081	1.00000		0.48662	0.51338
60	59	149	0.26526	0.73474		1.00000	0.77864	0.22136	60	149	59	0.73474	0.26526	1.00000		0.22136	0.77864

	FILTER A				PMT A	PMT A				FILTER B				PMT B	PMT B		
	yang	yin	PMT A	PMT A	yang	yin	net yang	net yin		yang	yin	PMT B	PMT B	yang	yin	net yang	net yin
Cycle	phi	phi	yang	yin	emission	emission	unemitted	unemitted	Cycle	phi	phi	yang	yin	emission	emission	unemitted	unemitted
61	60	150	0.25000	0.75000	1.00000		0.02864	0.97136	61	150	60	0.75000	0.25000		1.00000	0.97136	0.02864
62	61	151	0.23504	0.76496		1.00000	0.26368	0.73632	62	151	61	0.76496	0.23504	1.00000		0.73632	0.26368
63	62	152	0.22040	0.77960		1.00000	0.48408	0.51592	63	152	62	0.77960	0.22040	1.00000		0.51592	0.48408
64	63	153	0.20611	0.79389		1.00000	0.69019	0.30981	64	153	63	0.79389	0.20611	1.00000		0.30981	0.69019
65	64	154	0.19217	0.80783		1.00000	0.88236	0.11764	65	154	64	0.80783	0.19217	1.00000		0.11764	0.88236
66	65	155	0.17861	0.82139	1.00000		0.06097	0.93903	66	155	65	0.82139	0.17861		1.00000	0.93903	0.06097
67	66	156	0.16543	0.83457		1.00000	0.22640	0.77360	67	156	66	0.83457	0.16543	1.00000		0.77360	0.22640
68	67	157	0.15267	0.84733		1.00000	0.37907	0.62093	68	157	67	0.84733	0.15267	1.00000		0.62093	0.37907
69	68	158	0.14033	0.85967		1.00000	0.51940	0.48060	69	158	68	0.85967	0.14033	1.00000		0.48060	0.51940
70	69	159	0.12843	0.87157		1.00000	0.64783	0.35217	70	159	69	0.87157	0.12843	1.00000		0.35217	0.64783
71	70	160	0.11698	0.88302		1.00000	0.76481	0.23519	71	160	70	0.88302	0.11698	1.00000		0.23519	0.76481
72	71	161	0.10599	0.89401		1.00000	0.87080	0.12920	72	161	71	0.89401	0.10599	1.00000		0.12920	0.87080
73	72	162	0.09549	0.90451		1.00000	0.96629	0.03371	73	162	72	0.90451	0.09549	1.00000		0.03371	0.96629
74	73	163	0.08548	0.91452	1.00000		0.05178	0.94822	74	163	73	0.91452	0.08548		1.00000	0.94822	0.05178
75	74	164	0.07598	0.92402		1.00000	0.12775	0.87225	75	164	74	0.92402	0.07598	1.00000		0.87225	0.12775
76	75	165	0.06699	0.93301		1.00000	0.19474	0.80526	76	165	75	0.93301	0.06699	1.00000		0.80526	0.19474
77	76	166	0.05853	0.94147		1.00000	0.25327	0.74673	77	166	76	0.94147	0.05853	1.00000		0.74673	0.25327
78	77	167	0.05060	0.94940		1.00000	0.30387	0.69613	78	167	77	0.94940	0.05060	1.00000		0.69613	0.30387
79	78	168	0.04323	0.95677		1.00000	0.34710	0.65290	79	168	78	0.95677	0.04323	1.00000		0.65290	0.34710
80	79	169	0.03641	0.96359		1.00000	0.38350	0.61650	80	169	79	0.96359	0.03641	1.00000		0.61650	0.38350
81	80	170	0.03015	0.96985		1.00000	0.41366	0.58634	81	170	80	0.96985	0.03015	1.00000		0.58634	0.41366
82	81	171	0.02447	0.97553		1.00000	0.43813	0.56187	82	171	81	0.97553	0.02447	1.00000		0.56187	0.43813
83	82	172	0.01937	0.98063		1.00000	0.45750	0.54250	83	172	82	0.98063	0.01937	1.00000		0.54250	0.45750
84	83	173	0.01485	0.98515		1.00000	0.47235	0.52765	84	173	83	0.98515	0.01485	1.00000		0.52765	0.47235
85	84	174	0.01093	0.98907		1.00000	0.48328	0.51672	85	174	84	0.98907	0.01093	1.00000		0.51672	0.48328
86	85	175	0.00760	0.99240		1.00000	0.49087	0.50913	86	175	85	0.99240	0.00760	1.00000		0.50913	0.49087
87	86	176	0.00487	0.99513		1.00000	0.49574	0.50426	87	176	86	0.99513	0.00487	1.00000		0.50426	0.49574
88	87	177	0.00274	0.99726		1.00000	0.49848	0.50152	88	177	87	0.99726	0.00274	1.00000		0.50152	0.49848
89	88	178	0.00122	0.99878		1.00000	0.49970	0.50030	89	178	88	0.99878	0.00122	1.00000		0.50030	0.49970
90	89	179	0.00030	0.99970		1.00000	0.50000	0.50000	90	179	89	0.99970	0.00030	1.00000		0.50000	0.50000
91	90	180	0.00000	1.00000		1.00000	0.50000	0.50000	91	180	90	1.00000	0.00000	1.00000		0.50000	0.50000
92	91	181	0.00030	0.99970		1.00000	0.50030	0.49970	92	181	91	0.99970	0.00030	1.00000		0.49970	0.50030
93	92	182	0.00122	0.99878		1.00000	0.50152	0.49848	93	182	92	0.99878	0.00122	1.00000		0.49848	0.50152
94	93	183	0.00274	0.99726		1.00000	0.50426	0.49574	94	183	93	0.99726	0.00274	1.00000		0.49574	0.50426
95	94	184	0.00487	0.99513		1.00000	0.50913	0.49087	95	184	94	0.99513	0.00487	1.00000		0.49087	0.50913
96	95	185	0.00760	0.99240		1.00000	0.51672	0.48328	96	185	95	0.99240	0.00760	1.00000		0.48328	0.51672
97	96	186	0.01093	0.98907		1.00000	0.52765	0.47235	97	186	96	0.98907	0.01093	1.00000		0.47235	0.52765
98	97	187	0.01485	0.98515		1.00000	0.54250	0.45750	98	187	97	0.98515	0.01485	1.00000		0.45750	0.54250
99	98	188	0.01937	0.98063		1.00000	0.56187	0.43813	99	188	98	0.98063	0.01937	1.00000		0.43813	0.56187
100	99	189	0.02447	0.97553		1.00000	0.58634	0.41366	100	189	99	0.97553	0.02447	1.00000		0.41366	0.58634
101	100	190	0.03015	0.96985		1.00000	0.61650	0.38350	101	190	100	0.96985	0.03015	1.00000		0.38350	0.61650
102	101	191	0.03641	0.96359		1.00000	0.65290	0.34710	102	191	101	0.96359	0.03641	1.00000		0.34710	0.65290
103	102	192	0.04323	0.95677		1.00000	0.69613	0.30387	103	192	102	0.95677	0.04323	1.00000		0.30387	0.69613
104	103	193	0.05060	0.94940		1.00000	0.74673	0.25327	104	193	103	0.94940	0.05060	1.00000		0.25327	0.74673
105	104	194	0.05853	0.94147		1.00000	0.80526	0.19474	105	194	104	0.94147	0.05853	1.00000		0.19474	0.80526
106	105	195	0.06699	0.93301		1.00000	0.87225	0.12775	106	195	105	0.93301	0.06699	1.00000		0.12775	0.87225
107	106	196	0.07598	0.92402		1.00000	0.94822	0.05178	107	196	106	0.92402	0.07598	1.00000		0.05178	0.94822
108	107	197	0.08548	0.91452	1.00000		0.03371	0.96629	108	197	107	0.91452	0.08548		1.00000	0.96629	0.03371
109	108	198	0.09549	0.90451		1.00000	0.12920	0.87080	109	198	108	0.90451	0.09549	1.00000		0.87080	0.12920
110	109	199	0.10599	0.89401		1.00000	0.23519	0.76481	110	199	109	0.89401	0.10599	1.00000		0.76481	0.23519
111	110	200	0.11698	0.88302		1.00000	0.35217	0.64783	111	200	110	0.88302	0.11698	1.00000		0.64783	0.35217
112	111	201	0.12843	0.87157		1.00000	0.48060	0.51940	112	201	111	0.87157	0.12843	1.00000		0.51940	0.48060
113	112	202	0.14033	0.85967		1.00000	0.62093	0.37907	113	202	112	0.85967	0.14033	1.00000		0.37907	0.62093
114	113	203	0.15267	0.84733		1.00000	0.77360	0.22640	114	203	113	0.84733	0.15267	1.00000		0.22640	0.77360
115	114	204	0.16543	0.83457		1.00000	0.93903	0.06097	115	204	114	0.83457	0.16543	1.00000		0.06097	0.93903
116	115	205	0.17861	0.82139	1.00000		0.11764	0.88236	116	205	115	0.82139	0.17861		1.00000	0.88236	0.11764
117	116	206	0.19217	0.80783		1.00000	0.30981	0.69019	117	206	116	0.80783	0.19217	1.00000		0.69019	0.30981
118	117	207	0.20611	0.79389		1.00000	0.51592	0.48408	118	207	117	0.79389	0.20611	1.00000		0.48408	0.51592
119	118	208	0.22040	0.77960		1.00000	0.73632	0.26368	119	208	118	0.77960	0.22040	1.00000		0.26368	0.73632
120	119	209	0.23504	0.76496		1.00000	0.97136	0.02864	120	209	119	0.76496	0.23504	1.00000		0.02864	0.97136
121	120	210	0.25000	0.75000	1.00000		0.22136	0.77864	121	210	120	0.75000	0.25000		1.00000	0.77864	0.22136
122	121	211	0.26526	0.73474		1.00000	0.48662	0.51338	122	211	121	0.73474	0.26526	1.00000		0.51338	0.48662
123	122	212	0.28081	0.71919		1.00000	0.76744	0.23256	123	212	122	0.71919	0.28081	1.00000		0.23256	0.76744
124	123	213	0.29663	0.70337	1.00000		0.06407	0.93593	124	213	123	0.70337	0.29663		1.00000	0.93593	0.06407
125	124	214	0.31270	0.68730		1.00000	0.37677	0.62323	125	214	124	0.68730	0.31270	1.00000		0.62323	0.37677
126	125	215	0.32899	0.67101		1.00000	0.70576	0.29424	126	215	125	0.67101	0.32899	1.00000		0.29424	0.70576
127	126	216	0.34549	0.65451	1.00000		0.05125	0.94875	127	216	126	0.65451	0.34549		1.00000	0.94875	0.05125
128	127	217	0.36218	0.63782		1.00000	0.41343	0.58657	128	217	127	0.63782	0.36218	1.00000		0.58657	0.41343
129	128	218	0.37904	0.62096		1.00000	0.79247	0.20753	129	218	128	0.62096	0.37904	1.00000		0.20753	0.79247
130	129	219	0.39604	0.60396	1.00000		0.18851	0.81149	130	219	129	0.60396	0.39604		1.00000	0.81149	0.18851
131	130	220	0.41318	0.58682		1.00000	0.60169	0.39831	131	220	130	0.58682	0.41318	1.00000		0.39831	0.60169
132	131	221	0.43041	0.56959	1.00000		0.03210	0.96790	132	221	131	0.56959	0.43041		1.00000	0.96790	0.03210
133	132	222	0.44774	0.55226		1.00000	0.47984	0.52016	133	222	132	0.55226	0.44774	1.00000		0.52016	0.47984
134	133	223	0.46512	0.53488		1.00000	0.94496	0.05504	134	223	133	0.53488	0.46512	1.00000		0.05504	0.94496

	FILTER A				PMT A	PMT A				FILTER B				PMT B	PMT B		
	yang	yin	PMT A	PMT A	yang	yin	net yang	net yin		yang	yin	PMT B	PMT B	yang	yin	net yang	net yin
Cycle	phi	phi	yang	yin	emission	emission	unemitted	unemitted	Cycle	phi	phi	yang	yin	emission	emission	unemitted	unemitted
135	134	224	0.48255	0.51745	1.00000		0.42751	0.57249	135	224	134	0.51745	0.48255		1.00000	0.57249	0.42751
136	135	225	0.50000	0.50000		1.00000	0.92751	0.07249	136	225	135	0.50000	0.50000	1.00000		0.07249	0.92751
137	136	226	0.51745	0.48255	1.00000		0.44496	0.55504	137	226	136	0.48255	0.51745		1.00000	0.55504	0.44496
138	137	227	0.53488	0.46512		1.00000	0.97984	0.02016	138	227	137	0.46512	0.53488	1.00000		0.02016	0.97984
139	138	228	0.55226	0.44774	1.00000		0.53210	0.46790	139	228	138	0.44774	0.55226		1.00000	0.46790	0.53210
140	139	229	0.56959	0.43041	1.00000		0.10169	0.89831	140	229	139	0.43041	0.56959		1.00000	0.89831	0.10169
141	140	230	0.58682	0.41318		1.00000	0.68851	0.31149	141	230	140	0.41318	0.58682	1.00000		0.31149	0.68851
142	141	231	0.60396	0.39604	1.00000		0.29247	0.70753	142	231	141	0.39604	0.60396		1.00000	0.70753	0.29247
143	142	232	0.62096	0.37904		1.00000	0.91343	0.08657	143	232	142	0.37904	0.62096	1.00000		0.08657	0.91343
144	143	233	0.63782	0.36218	1.00000		0.55125	0.44875	144	233	143	0.36218	0.63782		1.00000	0.44875	0.55125
145	144	234	0.65451	0.34549	1.00000		0.20576	0.79424	145	234	144	0.34549	0.65451		1.00000	0.79424	0.20576
146	145	235	0.67101	0.32899		1.00000	0.87677	0.12323	146	235	145	0.32899	0.67101	1.00000		0.12323	0.87677
147	146	236	0.68730	0.31270	1.00000		0.56407	0.43593	147	236	146	0.31270	0.68730		1.00000	0.43593	0.56407
148	147	237	0.70337	0.29663	1.00000		0.26744	0.73256	148	237	147	0.29663	0.70337		1.00000	0.73256	0.26744
149	148	238	0.71919	0.28081		1.00000	0.98662	0.01338	149	238	148	0.28081	0.71919	1.00000		0.01338	0.98662
150	149	239	0.73474	0.26526	1.00000		0.72136	0.27864	150	239	149	0.26526	0.73474		1.00000	0.27864	0.72136
151	150	240	0.75000	0.25000	1.00000		0.47136	0.52864	151	240	150	0.25000	0.75000		1.00000	0.52864	0.47136
152	151	241	0.76496	0.23504	1.00000		0.23632	0.76368	152	241	151	0.23504	0.76496		1.00000	0.76368	0.23632
153	152	242	0.77960	0.22040	1.00000		0.01592	0.98408	153	242	152	0.22040	0.77960		1.00000	0.98408	0.01592
154	153	243	0.79389	0.20611		1.00000	0.80981	0.19019	154	243	153	0.20611	0.79389	1.00000		0.19019	0.80981
155	154	244	0.80783	0.19217	1.00000		0.61764	0.38236	155	244	154	0.19217	0.80783		1.00000	0.38236	0.61764
156	155	245	0.82139	0.17861	1.00000		0.43903	0.56097	156	245	155	0.17861	0.82139		1.00000	0.56097	0.43903
157	156	246	0.83457	0.16543	1.00000		0.27360	0.72640	157	246	156	0.16543	0.83457		1.00000	0.72640	0.27360
158	157	247	0.84733	0.15267	1.00000		0.12093	0.87907	158	247	157	0.15267	0.84733		1.00000	0.87907	0.12093
159	158	248	0.85967	0.14033		1.00000	0.98060	0.01940	159	248	158	0.14033	0.85967	1.00000		0.01940	0.98060
160	159	249	0.87157	0.12843	1.00000		0.85217	0.14783	160	249	159	0.12843	0.87157		1.00000	0.14783	0.85217
161	160	250	0.88302	0.11698	1.00000		0.73519	0.26481	161	250	160	0.11698	0.88302		1.00000	0.26481	0.73519
162	161	251	0.89401	0.10599	1.00000		0.62920	0.37080	162	251	161	0.10599	0.89401		1.00000	0.37080	0.62920
163	162	252	0.90451	0.09549	1.00000		0.53371	0.46629	163	252	162	0.09549	0.90451		1.00000	0.46629	0.53371
164	163	253	0.91452	0.08548	1.00000		0.44822	0.55178	164	253	163	0.08548	0.91452		1.00000	0.55178	0.44822
165	164	254	0.92402	0.07598	1.00000		0.37225	0.62775	165	254	164	0.07598	0.92402		1.00000	0.62775	0.37225
166	165	255	0.93301	0.06699	1.00000		0.30526	0.69474	166	255	165	0.06699	0.93301		1.00000	0.69474	0.30526
167	166	256	0.94147	0.05853	1.00000		0.24673	0.75327	167	256	166	0.05853	0.94147		1.00000	0.75327	0.24673
168	167	257	0.94940	0.05060	1.00000		0.19613	0.80387	168	257	167	0.05060	0.94940		1.00000	0.80387	0.19613
169	168	258	0.95677	0.04323	1.00000		0.15290	0.84710	169	258	168	0.04323	0.95677		1.00000	0.84710	0.15290
170	169	259	0.96359	0.03641	1.00000		0.11650	0.88350	170	259	169	0.03641	0.96359		1.00000	0.88350	0.11650
171	170	260	0.96985	0.03015	1.00000		0.08634	0.91366	171	260	170	0.03015	0.96985		1.00000	0.91366	0.08634
172	171	261	0.97553	0.02447	1.00000		0.06187	0.93813	172	261	171	0.02447	0.97553		1.00000	0.93813	0.06187
173	172	262	0.98063	0.01937	1.00000		0.04250	0.95750	173	262	172	0.01937	0.98063		1.00000	0.95750	0.04250
174	173	263	0.98515	0.01485	1.00000		0.02765	0.97235	174	263	173	0.01485	0.98515		1.00000	0.97235	0.02765
175	174	264	0.98907	0.01093	1.00000		0.01672	0.98328	175	264	174	0.01093	0.98907		1.00000	0.98328	0.01672
176	175	265	0.99240	0.00760	1.00000		0.00913	0.99087	176	265	175	0.00760	0.99240		1.00000	0.99087	0.00913
177	176	266	0.99513	0.00487	1.00000		0.00426	0.99574	177	266	176	0.00487	0.99513		1.00000	0.99574	0.00426
178	177	267	0.99726	0.00274	1.00000		0.00152	0.99848	178	267	177	0.00274	0.99726		1.00000	0.99848	0.00152
179	178	268	0.99878	0.00122	1.00000		0.00030	0.99970	179	268	178	0.00122	0.99878		1.00000	0.99970	0.00030
180	179	269	0.99970	0.00030	1.00000	1.00000	0.00000	0.00000	180	269	179	0.00030	0.99970	1.00000	1.00000	0.00000	0.00000
181	180	270	1.00000	0.00000	1.00000		0.00000	0.00000	181	270	180	0.00000	1.00000		1.00000	0.00000	0.00000
182	181	271	0.99970	0.00030			0.99970	0.00030	182	271	181	0.00030	0.99970			0.00030	0.99970
183	182	272	0.99878	0.00122	1.00000		0.99848	0.00152	183	272	182	0.00122	0.99878		1.00000	0.00152	0.99848
184	183	273	0.99726	0.00274	1.00000		0.99574	0.00426	184	273	183	0.00274	0.99726		1.00000	0.00426	0.99574
185	184	274	0.99513	0.00487	1.00000		0.99087	0.00913	185	274	184	0.00487	0.99513		1.00000	0.00913	0.99087
186	185	275	0.99240	0.00760	1.00000		0.98328	0.01672	186	275	185	0.00760	0.99240		1.00000	0.01672	0.98328
187	186	276	0.98907	0.01093	1.00000		0.97235	0.02765	187	276	186	0.01093	0.98907		1.00000	0.02765	0.97235
188	187	277	0.98515	0.01485	1.00000		0.95750	0.04250	188	277	187	0.01485	0.98515		1.00000	0.04250	0.95750
189	188	278	0.98063	0.01937	1.00000		0.93813	0.06187	189	278	188	0.01937	0.98063		1.00000	0.06187	0.93813
190	189	279	0.97553	0.02447	1.00000		0.91366	0.08634	190	279	189	0.02447	0.97553		1.00000	0.08634	0.91366
191	190	280	0.96985	0.03015	1.00000		0.88350	0.11650	191	280	190	0.03015	0.96985		1.00000	0.11650	0.88350
192	191	281	0.96359	0.03641	1.00000		0.84710	0.15290	192	281	191	0.03641	0.96359		1.00000	0.15290	0.84710
193	192	282	0.95677	0.04323	1.00000		0.80387	0.19613	193	282	192	0.04323	0.95677		1.00000	0.19613	0.80387
194	193	283	0.94940	0.05060	1.00000		0.75327	0.24673	194	283	193	0.05060	0.94940		1.00000	0.24673	0.75327
195	194	284	0.94147	0.05853	1.00000		0.69474	0.30526	195	284	194	0.05853	0.94147		1.00000	0.30526	0.69474
196	195	285	0.93301	0.06699	1.00000		0.62775	0.37225	196	285	195	0.06699	0.93301		1.00000	0.37225	0.62775
197	196	286	0.92402	0.07598	1.00000		0.55178	0.44822	197	286	196	0.07598	0.92402		1.00000	0.44822	0.55178
198	197	287	0.91452	0.08548	1.00000		0.46629	0.53371	198	287	197	0.08548	0.91452		1.00000	0.53371	0.46629
199	198	288	0.90451	0.09549	1.00000		0.37080	0.62920	199	288	198	0.09549	0.90451		1.00000	0.62920	0.37080
200	199	289	0.89401	0.10599	1.00000		0.26481	0.73519	200	289	199	0.10599	0.89401		1.00000	0.73519	0.26481
201	200	290	0.88302	0.11698	1.00000		0.14783	0.85217	201	290	200	0.11698	0.88302		1.00000	0.85217	0.14783
202	201	291	0.87157	0.12843	1.00000		0.01940	0.98060	202	291	201	0.12843	0.87157		1.00000	0.98060	0.01940
203	202	292	0.85967	0.14033		1.00000	0.87907	0.12093	203	292	202	0.14033	0.85967	1.00000		0.12093	0.87907
204	203	293	0.84733	0.15267	1.00000		0.72640	0.27360	204	293	203	0.15267	0.84733		1.00000	0.27360	0.72640
205	204	294	0.83457	0.16543	1.00000		0.56097	0.43903	205	294	204	0.16543	0.83457		1.00000	0.43903	0.56097
206	205	295	0.82139	0.17861	1.00000		0.38236	0.61764	206	295	205	0.17861	0.82139		1.00000	0.61764	0.38236
207	206	296	0.80783	0.19217	1.00000		0.19019	0.80981	207	296	206	0.19217	0.80783		1.00000	0.80981	0.19019
208	207	297	0.79389	0.20611		1.00000	0.98408	0.01592	208	297	207	0.20611	0.79389	1.00000		0.01592	0.98408

	FILTER A				PMT A	PMT A				FILTER B				PMT B	PMT B		
	yang	yin	PMT A	PMT A	yang	yin	net yang	net yin		yang	yin	PMT B	PMT B	yang	yin	net yang	net yin
Cycle	phi	phi	yang	yin	emission	emission	unemitted	unemitted	Cycle	phi	phi	yang	yin	emission	emission	unemitted	unemitted
209	208	298	0.77960	0.22040	1.00000		0.76368	0.23632	209	298	208	0.22040	0.77960		1.00000	0.23632	0.76368
210	209	299	0.76496	0.23504	1.00000		0.52864	0.47136	210	299	209	0.23504	0.76496		1.00000	0.47136	0.52864
211	210	300	0.75000	0.25000	1.00000		0.27864	0.72136	211	300	210	0.25000	0.75000		1.00000	0.72136	0.27864
212	211	301	0.73474	0.26526	1.00000		0.01338	0.98662	212	301	211	0.26526	0.73474		1.00000	0.98662	0.01338
213	212	302	0.71919	0.28081		1.00000	0.73256	0.26744	213	302	212	0.28081	0.71919	1.00000		0.26744	0.73256
214	213	303	0.70337	0.29663	1.00000		0.43593	0.56407	214	303	213	0.29663	0.70337		1.00000	0.56407	0.43593
215	214	304	0.68730	0.31270	1.00000		0.12323	0.87677	215	304	214	0.31270	0.68730		1.00000	0.87677	0.12323
216	215	305	0.67101	0.32899		1.00000	0.79424	0.20576	216	305	215	0.32899	0.67101	1.00000		0.20576	0.79424
217	216	306	0.65451	0.34549	1.00000		0.44875	0.55125	217	306	216	0.34549	0.65451		1.00000	0.55125	0.44875
218	217	307	0.63782	0.36218	1.00000		0.08657	0.91343	218	307	217	0.36218	0.63782		1.00000	0.91343	0.08657
219	218	308	0.62096	0.37904		1.00000	0.70753	0.29247	219	308	218	0.37904	0.62096	1.00000		0.29247	0.70753
220	219	309	0.60396	0.39604	1.00000		0.31149	0.68851	220	309	219	0.39604	0.60396		1.00000	0.68851	0.31149
221	220	310	0.58682	0.41318		1.00000	0.89831	0.10169	221	310	220	0.41318	0.58682	1.00000		0.10169	0.89831
222	221	311	0.56959	0.43041	1.00000		0.46790	0.53210	222	311	221	0.43041	0.56959		1.00000	0.53210	0.46790
223	222	312	0.55226	0.44774	1.00000		0.02016	0.97984	223	312	222	0.44774	0.55226		1.00000	0.97984	0.02016
224	223	313	0.53488	0.46512		1.00000	0.55504	0.44496	224	313	223	0.46512	0.53488	1.00000		0.44496	0.55504
225	224	314	0.51745	0.48255	1.00000		0.07249	0.92751	225	314	224	0.48255	0.51745		1.00000	0.92751	0.07249
226	225	315	0.50000	0.50000		1.00000	0.57249	0.42751	226	315	225	0.50000	0.50000	1.00000		0.42751	0.57249
227	226	316	0.48255	0.51745	1.00000		0.05504	0.94496	227	316	226	0.51745	0.48255		1.00000	0.94496	0.05504
228	227	317	0.46512	0.53488		1.00000	0.52016	0.47984	228	317	227	0.53488	0.46512	1.00000		0.47984	0.52016
229	228	318	0.44774	0.55226		1.00000	0.96790	0.03210	229	318	228	0.55226	0.44774	1.00000		0.03210	0.96790
230	229	319	0.43041	0.56959	1.00000		0.39831	0.60169	230	319	229	0.56959	0.43041		1.00000	0.60169	0.39831
231	230	320	0.41318	0.58682		1.00000	0.81149	0.18851	231	320	230	0.58682	0.41318	1.00000		0.18851	0.81149
232	231	321	0.39604	0.60396	1.00000		0.20753	0.79247	232	321	231	0.60396	0.39604		1.00000	0.79247	0.20753
233	232	322	0.37904	0.62096		1.00000	0.58657	0.41343	233	322	232	0.62096	0.37904	1.00000		0.41343	0.58657
234	233	323	0.36218	0.63782		1.00000	0.94875	0.05125	234	323	233	0.63782	0.36218	1.00000		0.05125	0.94875
235	234	324	0.34549	0.65451	1.00000		0.29424	0.70576	235	324	234	0.65451	0.34549		1.00000	0.70576	0.29424
236	235	325	0.32899	0.67101		1.00000	0.62323	0.37677	236	325	235	0.67101	0.32899	1.00000		0.37677	0.62323
237	236	326	0.31270	0.68730		1.00000	0.93593	0.06407	237	326	236	0.68730	0.31270	1.00000		0.06407	0.93593
238	237	327	0.29663	0.70337	1.00000		0.23256	0.76744	238	327	237	0.70337	0.29663		1.00000	0.76744	0.23256
239	238	328	0.28081	0.71919		1.00000	0.51338	0.48662	239	328	238	0.71919	0.28081	1.00000		0.48662	0.51338
240	239	329	0.26526	0.73474		1.00000	0.77864	0.22136	240	329	239	0.73474	0.26526	1.00000		0.22136	0.77864
241	240	330	0.25000	0.75000	1.00000		0.02864	0.97136	241	330	240	0.75000	0.25000		1.00000	0.97136	0.02864
242	241	331	0.23504	0.76496		1.00000	0.26368	0.73632	242	331	241	0.76496	0.23504	1.00000		0.73632	0.26368
243	242	332	0.22040	0.77960		1.00000	0.48408	0.51592	243	332	242	0.77960	0.22040	1.00000		0.51592	0.48408
244	243	333	0.20611	0.79389		1.00000	0.69019	0.30981	244	333	243	0.79389	0.20611	1.00000		0.30981	0.69019
245	244	334	0.19217	0.80783		1.00000	0.88236	0.11764	245	334	244	0.80783	0.19217	1.00000		0.11764	0.88236
246	245	335	0.17861	0.82139	1.00000		0.06097	0.93903	246	335	245	0.82139	0.17861		1.00000	0.93903	0.06097
247	246	336	0.16543	0.83457		1.00000	0.22640	0.77360	247	336	246	0.83457	0.16543	1.00000		0.77360	0.22640
248	247	337	0.15267	0.84733		1.00000	0.37907	0.62093	248	337	247	0.84733	0.15267	1.00000		0.62093	0.37907
249	248	338	0.14033	0.85967		1.00000	0.51940	0.48060	249	338	248	0.85967	0.14033	1.00000		0.48060	0.51940
250	249	339	0.12843	0.87157		1.00000	0.64783	0.35217	250	339	249	0.87157	0.12843	1.00000		0.35217	0.64783
251	250	340	0.11698	0.88302		1.00000	0.76481	0.23519	251	340	250	0.88302	0.11698	1.00000		0.23519	0.76481
252	251	341	0.10599	0.89401		1.00000	0.87080	0.12920	252	341	251	0.89401	0.10599	1.00000		0.12920	0.87080
253	252	342	0.09549	0.90451		1.00000	0.96629	0.03371	253	342	252	0.90451	0.09549	1.00000		0.03371	0.96629
254	253	343	0.08548	0.91452	1.00000		0.05178	0.94822	254	343	253	0.91452	0.08548		1.00000	0.94822	0.05178
255	254	344	0.07598	0.92402		1.00000	0.12775	0.87225	255	344	254	0.92402	0.07598	1.00000		0.87225	0.12775
256	255	345	0.06699	0.93301		1.00000	0.19474	0.80526	256	345	255	0.93301	0.06699	1.00000		0.80526	0.19474
257	256	346	0.05853	0.94147		1.00000	0.25327	0.74673	257	346	256	0.94147	0.05853	1.00000		0.74673	0.25327
258	257	347	0.05060	0.94940		1.00000	0.30387	0.69613	258	347	257	0.94940	0.05060	1.00000		0.69613	0.30387
259	258	348	0.04323	0.95677		1.00000	0.34710	0.65290	259	348	258	0.95677	0.04323	1.00000		0.65290	0.34710
260	259	349	0.03641	0.96359		1.00000	0.38350	0.61650	260	349	259	0.96359	0.03641	1.00000		0.61650	0.38350
261	260	350	0.03015	0.96985		1.00000	0.41366	0.58634	261	350	260	0.96985	0.03015	1.00000		0.58634	0.41366
262	261	351	0.02447	0.97553		1.00000	0.43813	0.56187	262	351	261	0.97553	0.02447	1.00000		0.56187	0.43813
263	262	352	0.01937	0.98063		1.00000	0.45750	0.54250	263	352	262	0.98063	0.01937	1.00000		0.54250	0.45750
264	263	353	0.01485	0.98515		1.00000	0.47235	0.52765	264	353	263	0.98515	0.01485	1.00000		0.52765	0.47235
265	264	354	0.01093	0.98907		1.00000	0.48328	0.51672	265	354	264	0.98907	0.01093	1.00000		0.51672	0.48328
266	265	355	0.00760	0.99240		1.00000	0.49087	0.50913	266	355	265	0.99240	0.00760	1.00000		0.50913	0.49087
267	266	356	0.00487	0.99513		1.00000	0.49574	0.50426	267	356	266	0.99513	0.00487	1.00000		0.50426	0.49574
268	267	357	0.00274	0.99726		1.00000	0.49848	0.50152	268	357	267	0.99726	0.00274	1.00000		0.50152	0.49848
269	268	358	0.00122	0.99878		1.00000	0.49970	0.50030	269	358	268	0.99878	0.00122	1.00000		0.50030	0.49970
270	269	359	0.00030	0.99970		1.00000	0.50000	0.50000	270	359	269	0.99970	0.00030	1.00000		0.50000	0.50000
271	270	0	0.00000	1.00000	0.00000	1.00000	0.50000	0.50000	271	0	270	1.00000	0.00000	1.00000		0.50000	0.50000
272	271	1	0.00030	0.99970		1.00000	0.50030	0.49970	272	1	271	0.99970	0.00030	1.00000		0.49970	0.50030
273	272	2	0.00122	0.99878		1.00000	0.50152	0.49848	273	2	272	0.99878	0.00122	1.00000		0.49848	0.50152
274	273	3	0.00274	0.99726		1.00000	0.50426	0.49574	274	3	273	0.99726	0.00274	1.00000		0.49574	0.50426
275	274	4	0.00487	0.99513		1.00000	0.50913	0.49087	275	4	274	0.99513	0.00487	1.00000		0.49087	0.50913
276	275	5	0.00760	0.99240		1.00000	0.51672	0.48328	276	5	275	0.99240	0.00760	1.00000		0.48328	0.51672
277	276	6	0.01093	0.98907		1.00000	0.52765	0.47235	277	6	276	0.98907	0.01093	1.00000		0.47235	0.52765
278	277	7	0.01485	0.98515		1.00000	0.54250	0.45750	278	7	277	0.98515	0.01485	1.00000		0.45750	0.54250
279	278	8	0.01937	0.98063		1.00000	0.56187	0.43813	279	8	278	0.98063	0.01937	1.00000		0.43813	0.56187
280	279	9	0.02447	0.97553		1.00000	0.58634	0.41366	280	9	279	0.97553	0.02447	1.00000		0.41366	0.58634
281	280	10	0.03015	0.96985		1.00000	0.61650	0.38350	281	10	280	0.96985	0.03015	1.00000		0.38350	0.61650
282	281	11	0.03641	0.96359		1.00000	0.65290	0.34710	282	11	281	0.96359	0.03641	1.00000		0.34710	0.65290

Cycle	FILTER A yang phi	FILTER A yin phi	PMT A yang	PMT A yin	PMT A yang emission	PMT A yin emission	net yang unemitted	net yin unemitted	Cycle	FILTER B yang phi	FILTER B yin phi	PMT B yang	PMT B yin	PMT B yang emission	PMT B yin emission	net yang unemitted	net yin unemitted
283	282	12	0.04323	0.95677		1.00000	0.69613	0.30387	283	12	282	0.95677	0.04323	1.00000		0.30387	0.69613
284	283	13	0.05060	0.94940		1.00000	0.74673	0.25327	284	13	283	0.94940	0.05060	1.00000		0.25327	0.74673
285	284	14	0.05853	0.94147		1.00000	0.80526	0.19474	285	14	284	0.94147	0.05853	1.00000		0.19474	0.80526
286	285	15	0.06699	0.93301		1.00000	0.87225	0.12775	286	15	285	0.93301	0.06699	1.00000		0.12775	0.87225
287	286	16	0.07598	0.92402		1.00000	0.94822	0.05178	287	16	286	0.92402	0.07598	1.00000		0.05178	0.94822
288	287	17	0.08548	0.91452	1.00000		0.03371	0.96629	288	17	287	0.91452	0.08548		1.00000	0.96629	0.03371
289	288	18	0.09549	0.90451		1.00000	0.12920	0.87080	289	18	288	0.90451	0.09549	1.00000		0.87080	0.12920
290	289	19	0.10599	0.89401		1.00000	0.23519	0.76481	290	19	289	0.89401	0.10599	1.00000		0.76481	0.23519
291	290	20	0.11698	0.88302		1.00000	0.35217	0.64783	291	20	290	0.88302	0.11698	1.00000		0.64783	0.35217
292	291	21	0.12843	0.87157		1.00000	0.48060	0.51940	292	21	291	0.87157	0.12843	1.00000		0.51940	0.48060
293	292	22	0.14033	0.85967		1.00000	0.62093	0.37907	293	22	292	0.85967	0.14033	1.00000		0.37907	0.62093
294	293	23	0.15267	0.84733		1.00000	0.77360	0.22640	294	23	293	0.84733	0.15267	1.00000		0.22640	0.77360
295	294	24	0.16543	0.83457		1.00000	0.93903	0.06097	295	24	294	0.83457	0.16543	1.00000		0.06097	0.93903
296	295	25	0.17861	0.82139	1.00000		0.11764	0.88236	296	25	295	0.82139	0.17861		1.00000	0.88236	0.11764
297	296	26	0.19217	0.80783		1.00000	0.30981	0.69019	297	26	296	0.80783	0.19217	1.00000		0.69019	0.30981
298	297	27	0.20611	0.79389		1.00000	0.51592	0.48408	298	27	297	0.79389	0.20611	1.00000		0.48408	0.51592
299	298	28	0.22040	0.77960		1.00000	0.73632	0.26368	299	28	298	0.77960	0.22040	1.00000		0.26368	0.73632
300	299	29	0.23504	0.76496		1.00000	0.97136	0.02864	300	29	299	0.76496	0.23504	1.00000		0.02864	0.97136
301	300	30	0.25000	0.75000	1.00000		0.22136	0.77864	301	30	300	0.75000	0.25000		1.00000	0.77864	0.22136
302	301	31	0.26526	0.73474		1.00000	0.48662	0.51338	302	31	301	0.73474	0.26526	1.00000		0.51338	0.48662
303	302	32	0.28081	0.71919		1.00000	0.76744	0.23256	303	32	302	0.71919	0.28081	1.00000		0.23256	0.76744
304	303	33	0.29663	0.70337	1.00000		0.06407	0.93593	304	33	303	0.70337	0.29663		1.00000	0.93593	0.06407
305	304	34	0.31270	0.68730		1.00000	0.37677	0.62323	305	34	304	0.68730	0.31270	1.00000		0.62323	0.37677
306	305	35	0.32899	0.67101		1.00000	0.70576	0.29424	306	35	305	0.67101	0.32899	1.00000		0.29424	0.70576
307	306	36	0.34549	0.65451	1.00000		0.05125	0.94875	307	36	306	0.65451	0.34549		1.00000	0.94875	0.05125
308	307	37	0.36218	0.63782		1.00000	0.41343	0.58657	308	37	307	0.63782	0.36218	1.00000		0.58657	0.41343
309	308	38	0.37904	0.62096		1.00000	0.79247	0.20753	309	38	308	0.62096	0.37904	1.00000		0.20753	0.79247
310	309	39	0.39604	0.60396	1.00000		0.18851	0.81149	310	39	309	0.60396	0.39604		1.00000	0.81149	0.18851
311	310	40	0.41318	0.58682		1.00000	0.60169	0.39831	311	40	310	0.58682	0.41318	1.00000		0.39831	0.60169
312	311	41	0.43041	0.56959	1.00000		0.03210	0.96790	312	41	311	0.56959	0.43041		1.00000	0.96790	0.03210
313	312	42	0.44774	0.55226		1.00000	0.47984	0.52016	313	42	312	0.55226	0.44774	1.00000		0.52016	0.47984
314	313	43	0.46512	0.53488		1.00000	0.94496	0.05504	314	43	313	0.53488	0.46512	1.00000		0.05504	0.94496
315	314	44	0.48255	0.51745	1.00000		0.42751	0.57249	315	44	314	0.51745	0.48255		1.00000	0.57249	0.42751
316	315	45	0.50000	0.50000		1.00000	0.92751	0.07249	316	45	315	0.50000	0.50000	1.00000		0.07249	0.92751
317	316	46	0.51745	0.48255	1.00000		0.44496	0.55504	317	46	316	0.48255	0.51745		1.00000	0.55504	0.44496
318	317	47	0.53488	0.46512		1.00000	0.97984	0.02016	318	47	317	0.46512	0.53488	1.00000		0.02016	0.97984
319	318	48	0.55226	0.44774	1.00000		0.53210	0.46790	319	48	318	0.44774	0.55226		1.00000	0.46790	0.53210
320	319	49	0.56959	0.43041	1.00000		0.10169	0.89831	320	49	319	0.43041	0.56959		1.00000	0.89831	0.10169
321	320	50	0.58682	0.41318		1.00000	0.68851	0.31149	321	50	320	0.41318	0.58682	1.00000		0.31149	0.68851
322	321	51	0.60396	0.39604	1.00000		0.29247	0.70753	322	51	321	0.39604	0.60396		1.00000	0.70753	0.29247
323	322	52	0.62096	0.37904		1.00000	0.91343	0.08657	323	52	322	0.37904	0.62096	1.00000		0.08657	0.91343
324	323	53	0.63782	0.36218	1.00000		0.55125	0.44875	324	53	323	0.36218	0.63782		1.00000	0.44875	0.55125
325	324	54	0.65451	0.34549	1.00000		0.20576	0.79424	325	54	324	0.34549	0.65451		1.00000	0.79424	0.20576
326	325	55	0.67101	0.32899		1.00000	0.87677	0.12323	326	55	325	0.32899	0.67101	1.00000		0.12323	0.87677
327	326	56	0.68730	0.31270	1.00000		0.56407	0.43593	327	56	326	0.31270	0.68730		1.00000	0.43593	0.56407
328	327	57	0.70337	0.29663	1.00000		0.26744	0.73256	328	57	327	0.29663	0.70337		1.00000	0.73256	0.26744
329	328	58	0.71919	0.28081		1.00000	0.98662	0.01338	329	58	328	0.28081	0.71919	1.00000		0.01338	0.98662
330	329	59	0.73474	0.26526	1.00000		0.72136	0.27864	330	59	329	0.26526	0.73474		1.00000	0.27864	0.72136
331	330	60	0.75000	0.25000	1.00000		0.47136	0.52864	331	60	330	0.25000	0.75000		1.00000	0.52864	0.47136
332	331	61	0.76496	0.23504	1.00000		0.23632	0.76368	332	61	331	0.23504	0.76496		1.00000	0.76368	0.23632
333	332	62	0.77960	0.22040	1.00000		0.01592	0.98408	333	62	332	0.22040	0.77960		1.00000	0.98408	0.01592
334	333	63	0.79389	0.20611		1.00000	0.80981	0.19019	334	63	333	0.20611	0.79389	1.00000		0.19019	0.80981
335	334	64	0.80783	0.19217	1.00000		0.61764	0.38236	335	64	334	0.19217	0.80783		1.00000	0.38236	0.61764
336	335	65	0.82139	0.17861	1.00000		0.43903	0.56097	336	65	335	0.17861	0.82139		1.00000	0.56097	0.43903
337	336	66	0.83457	0.16543	1.00000		0.27360	0.72640	337	66	336	0.16543	0.83457		1.00000	0.72640	0.27360
338	337	67	0.84733	0.15267	1.00000		0.12093	0.87907	338	67	337	0.15267	0.84733		1.00000	0.87907	0.12093
339	338	68	0.85967	0.14033		1.00000	0.98060	0.01940	339	68	338	0.14033	0.85967	1.00000		0.01940	0.98060
340	339	69	0.87157	0.12843	1.00000		0.85217	0.14783	340	69	339	0.12843	0.87157		1.00000	0.14783	0.85217
341	340	70	0.88302	0.11698	1.00000		0.73519	0.26481	341	70	340	0.11698	0.88302		1.00000	0.26481	0.73519
342	341	71	0.89401	0.10599	1.00000		0.62920	0.37080	342	71	341	0.10599	0.89401		1.00000	0.37080	0.62920
343	342	72	0.90451	0.09549	1.00000		0.53371	0.46629	343	72	342	0.09549	0.90451		1.00000	0.46629	0.53371
344	343	73	0.91452	0.08548	1.00000		0.44822	0.55178	344	73	343	0.08548	0.91452		1.00000	0.55178	0.44822
345	344	74	0.92402	0.07598	1.00000		0.37225	0.62775	345	74	344	0.07598	0.92402		1.00000	0.62775	0.37225
346	345	75	0.93301	0.06699	1.00000		0.30526	0.69474	346	75	345	0.06699	0.93301		1.00000	0.69474	0.30526
347	346	76	0.94147	0.05853	1.00000		0.24673	0.75327	347	76	346	0.05853	0.94147		1.00000	0.75327	0.24673
348	347	77	0.94940	0.05060	1.00000		0.19613	0.80387	348	77	347	0.05060	0.94940		1.00000	0.80387	0.19613
349	348	78	0.95677	0.04323	1.00000		0.15290	0.84710	349	78	348	0.04323	0.95677		1.00000	0.84710	0.15290
350	349	79	0.96359	0.03641	1.00000		0.11650	0.88350	350	79	349	0.03641	0.96359		1.00000	0.88350	0.11650
351	350	80	0.96985	0.03015	1.00000		0.08634	0.91366	351	80	350	0.03015	0.96985		1.00000	0.91366	0.08634
352	351	81	0.97553	0.02447	1.00000		0.06187	0.93813	352	81	351	0.02447	0.97553		1.00000	0.93813	0.06187
353	352	82	0.98063	0.01937	1.00000		0.04250	0.95750	353	82	352	0.01937	0.98063		1.00000	0.95750	0.04250
354	353	83	0.98515	0.01485	1.00000		0.02765	0.97235	354	83	353	0.01485	0.98515		1.00000	0.97235	0.02765
355	354	84	0.98907	0.01093	1.00000		0.01672	0.98328	355	84	354	0.01093	0.98907		1.00000	0.98328	0.01672
356	355	85	0.99240	0.00760	1.00000		0.00913	0.99087	356	85	355	0.00760	0.99240		1.00000	0.99087	0.00913
357	356	86	0.99513	0.00487	1.00000		0.00426	0.99574	357	86	356	0.00487	0.99513		1.00000	0.99574	0.00426
358	357	87	0.99726	0.00274	1.00000		0.00152	0.99848	358	87	357	0.00274	0.99726		1.00000	0.99848	0.00152
359	358	88	0.99878	0.00122	1.00000		0.00030	0.99970	359	88	358	0.00122	0.99878		1.00000	0.99970	0.00030
360	359	89	0.99970	0.00030	1.00000	1.00000	0.00000	0.00000	360	89	359	0.00030	0.99970	1.00000	1.00000	0.00000	0.00000

6.7 The SPU Outcome When Both Filters Are Set at a Common Alignment ($\theta = 0^o$)

When both CH74 polarizers are set to a common angle, a PMT reading on one side will always be matched by a PMT reading on the other. No matter what the common angle, it is always (or almost always) the case that a reading on one side will generate a coincidence.

Bell's theorem, when interpreted for and applied to photons, assumes, for the classical case, that a photon having phase quadrature would have a 50% chance of being passed by each filter and a 50% chance of being blocked. This means that a coincidence would occur only 50% of the time a registration occurs, not 100%. Further, with the SPU model, there is neither a possibility for superluminal speeds nor the belief that photons, through some hidden force, communicate with each other at a distance.

The SPU law of conservation with respect to directons, introduced in Chapter Two, requires that in every interaction between directons, the resultant must conserve the balance of equal opposites in the universe by conserving the speed, alignment, and character brought to the interaction by its participants. I now present the corollary to this.

The Corollary to the SPU Law of Directon Conservation
Under *ceteris paribus* conditions, identically
structured events will produce identical outcomes.

This rule is served by the experiment's requirement that the photon pairs be correlated. The SPU interpretation of the CH74 device, about to be presented, makes four assumptions concerning the "entanglement" of "two" photons. First, both photons are simultaneously released. Second, polarization analyzers are the same distance from the photon source and identical in structure; the same holds for both PMT detectors. Third, both analyzers "see" the same direction of rotation for incoming photons. Finally, both circularly polarized photons, even if initially of differing wavelengths, are truly entangled by being "homogenized" through collection, filtering, phase quadrature, and lens refinements into common frequency properties with a common speed of rotation.

Given the corollary to the SPU first law of conservation of the law, the above four assumptions, the character of SPU matter, the nature of SPU light and the character of SPU phase quadrature, the following statements can be made:

1. In a SPU polarizing film, the loopon cores have a parallel alignment identified as *the axis of transmission*.
2. A linearly polarized SPU photon is an alternating sequence of separated but aligned "linearly-shaped" momenton fields, yang (crest) followed by yin (trough) followed by yang, etc., whose wavelength is the distance between two sequential yang fields or yin fields, as created by phase quadrature.
3. With circular polarization, each field maintains its original alignment; however, as each field is pulsed at birth, it takes on a slight angular difference with the pulsed field that preceded it.
4. For circularly polarized SPU light having phase quadrature, the pulsed rotation continues but each yin pulse is at 90^o to the yang pulse immediately preceding it.
5. For every orientation of a polarizing film's axis of transmission there will be only two settings, 180^o apart, in each rotation where all the momentons in a yang field are passed to its PMT. The same is true for the yin fields in that rotation.
6. These settings mark the four *energy maximization alignments*.

7. The two energy maximization alignments for the yin fields will always be at 90º to those of the yang fields.
8. When two CH74 polarizing films have a commonly aligned axis of transmission, the energy maximization alignments for photon A and its assigned film and the energy maximization alignments for photon B and its assigned film will be identical.
10. The PMTs behind each polarization analyzer, at any given moment, will be receiving identical amounts of energy, though the yin and yang character of that energy will differ.
11. Always, when both polarizing films have a common setting for their axes of transmission, when PMT A is in the house of Yang (receiving the maximum number of yang momentons) PMT B will also be in the house of yang (receiving the maximum number of yang momentons).
12. Always, when both polarizing films have a common setting for their axes of transmission, when PMT A is in the house of Yin (receiving the maximum number of yin momentons) PMT B will also be in the house of yin (receiving the maximum number of yin momentons).
13. In the SPU, the yang super loopons in the PMTs will have a mass 1,836 times greater than the yin super loopons.
14. Through Y interactions, yin momentons tend to accelerate yin super loopons and yang momentons tend to accelerate yang super loopons.
15. The proton-electron mass imbalance in loopon mass in the PMTs means that the yin momentons will far more likely cause the ejection of a negative yin super loopon than the yang momentons will cause the ejection of a positive yang super loopon.
16. The PMTs initiate an energy cascade when a yin super loopon (electron) is accelerated to a point of ejection from its orbit around its yang host.
17. There is a number, X, which represents the number of yin momentons needed for the ejection of a yin super loopon within a PMT. This number is most likely reached when a PMT is in the house of yin and least likely reached when a PMT is in the house of yang.
18. Always, when both polarizing films have a common setting for their axes of transmission, PMT A and PMT B both reach the number X at the same time.

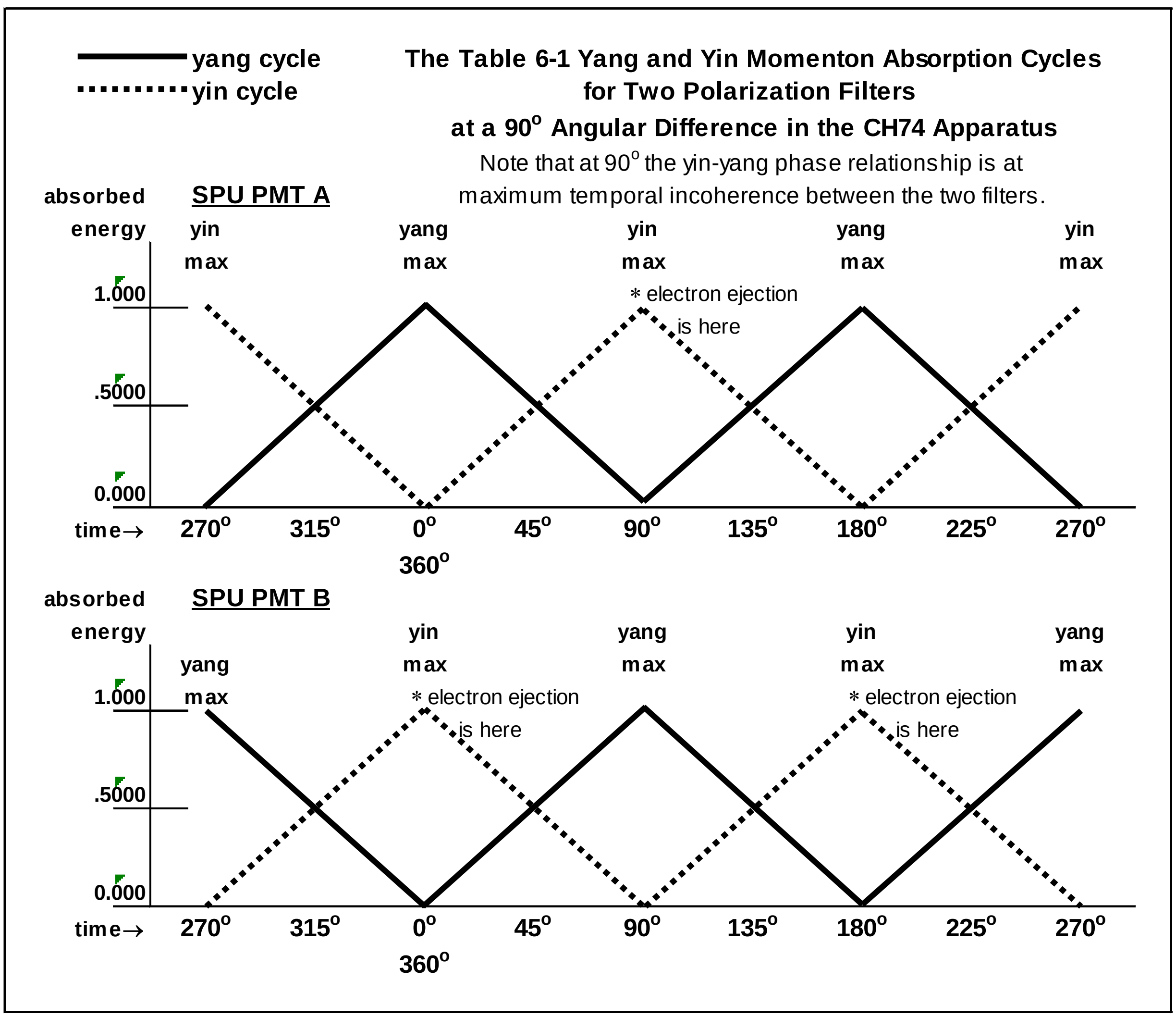
Therefore, when both CH74 polarizers are set at a common alignment (θ = 0º), when PMT A records a hit, the probability of a hit on PMT B will be 1.00000.

6.8 The SPU Outcome When Both CH74 Filters Are Set at 90° Apart

The important element in Table 6-1 is captured in Sketch 6-11 below. During each rotation of circularly polarized light, when the two CH74 polarizing films are set at 90° apart, the positive momentons reaching one PMT are out of phase by 90° with the negative momentons reaching the opposing PMT. The energy is in symmetry but the character (positive or negative) of that energy is not in symmetry. This means nothing to our physics because we cannot imagine the separation of a wave cycle's crest from its trough. This lapse creates the illusion of a common wave function. But, with SPU phase quadrature and SPU polarization analyzers, such a separation can occur.

Though the energy reemitted (or passed if you prefer) by the polarization analyzers is equal on both sides, to mimic the PMTs in the CH74 experiment the yang super loopons in the SPU PMTs are assigned a mass 1,836 times greater than the yin super loopons. The result is that a yin super loopon, with a mass only 1/1836 of the yang super loopon, will be much more affected by the negative momentons than the positive momentons due to acceleration by the Y interaction. The yin super loopon plays the same role in the SPU CH74 experiment that an electron plays in the CH74 experiment done in our universe.

Sketch 6-11



Through Y interactions, yin momentons tend to accelerate yin super loopons and yang momentons tend to accelerate yang super loopons. Yin momentons are to the SPU what electromagnetic troughs are to us and yang momentons are as the crests. This model argues that the two sides in the CH74 device can differentially emit electromagnetic “crests” and electromagnetic “troughs.”

There is no imbalance in the amount of energy. Yet, when the axes of transmission of the two CH74 polarizing films are set at 90º apart, the left PMT is primarily receiving yang momentons while the right PMT is primarily receiving yin momentons. This is the imbalance. Accordingly, the imbalance in loopon mass in the PMTs means that the yin momentons will far more likely cause the ejection of a negative yin loopon than the yang momentons will cause the ejection of a positive yang loopon. Our interpretation of the popcorn effect must take into consideration the proton-electron mass distinction. As an analogy, given equal distance, the blast from a 12 gauge shotgun will kick a marble much further than it will kick a bowling ball.

The quantum theoretic prediction is that when the axes of transmission of the two CH74 polarizing films are set at 90º apart, a PMT reading on one side will never be matched by a PMT reading on the other. The SPU rationale given above reveals an outcome close to that prediction. Table 6-1 reveals that when the two axes of transmission of the two CH74 polarizing films are set at 90º apart in the SPU, the probability for a yin-yang coincident hit will be only .00555 (1/180). Though this differs from the quantum theoretic prediction by a little over 0.5 %, I believe it can be explained by Sketch 6-6. Even at 90º to the alignment of a super loopon's core, not all of a linearly polarized momenton field will pass. This 0.5 % difference in prediction can be used as a test for the SPU model. At the least, it is proof the SPU model can be tested through empirical quantitative predictions.

Therefore, when both SPU CH74 polarizers are set at a right angle to each other (θ =90º), when SPU PMT A records a hit, the probability of a hit on SPU PMT B will only be .00555.

6.9 The SPU Outcome When Both CH74 Filters Are Set at Any Different Angle

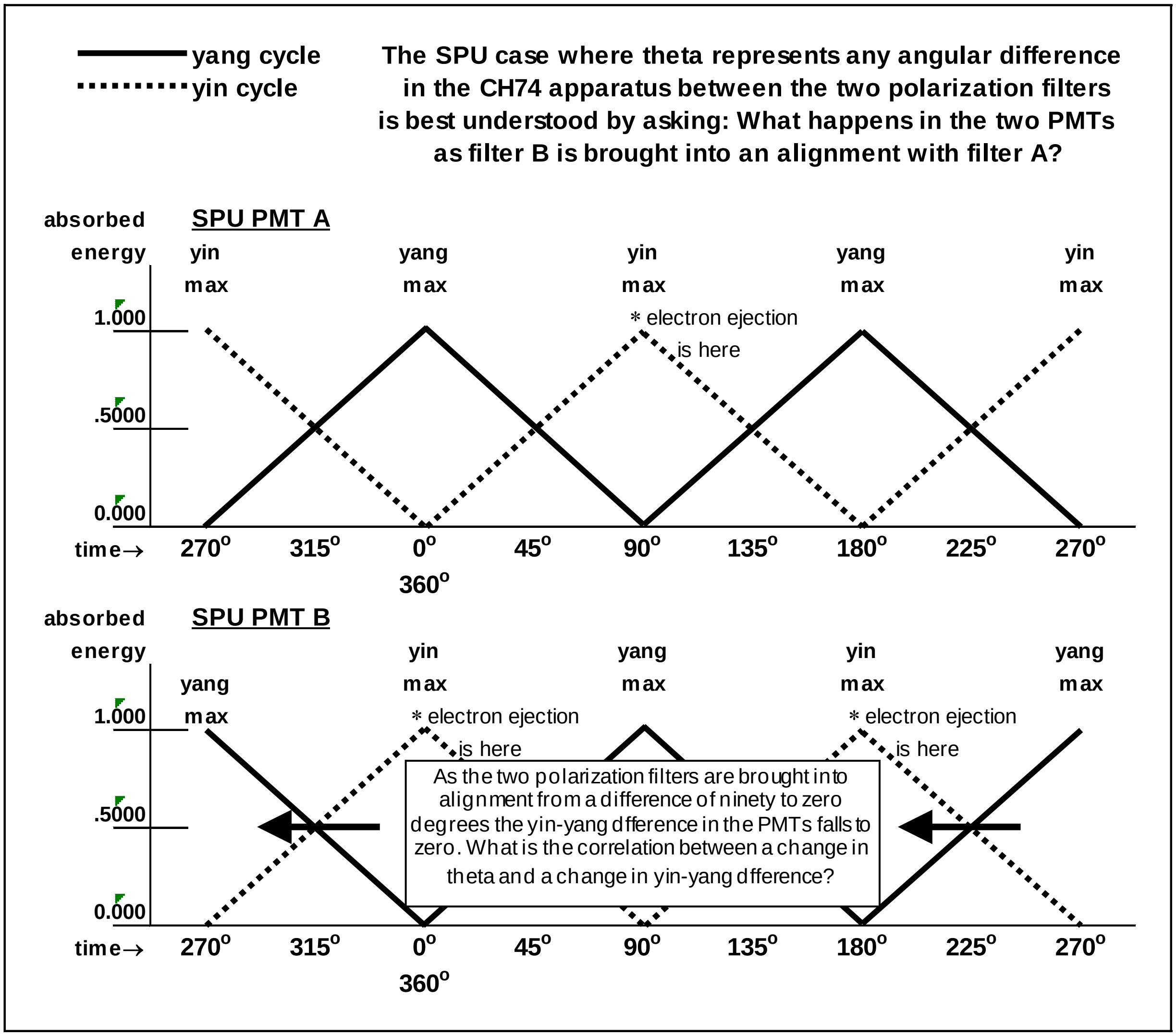
We have just seen that when theta, the angle between the two axes of transmission of the two SPU CH74 polarizing films, is 0º a hit on one SPU PMT will always be matched by a hit on the other and when theta is 90º a hit on one SPU PMT will only by matched about .5 percent of the time. Sketch 6-12 merely points out that, when both filters are set at any different angle, the SPU CH74 outcome can still be conceptually approached from the information provided by table 6-1. Because the yin peak in each PMT always follows the yang peak at 90º in the rotation of the circular light and vice-versa, and because in this section we are seeking the values belonging to incremental changes in coincidence as the yin peak on the B PMT is brought into alignment, I use theta as an angle between 0º and 90º.

Consistent with Table 6-1and the fact that the PMTs in our CH74 device are made from equal numbers of positive particles and negative particles, the former having a mass 1,836 times greater than the latter, my model holds that a PMT registration (hit) will most likely take place at or around the peak of one of the two yin periods in each rotation of the circularly polarized light. That is, during a time when the SPU PMT is primarily being bombarded by negative momentons.

It is during the peak of one of these bombardments that a negative loopon (the SPU counterpart of our electron) will be most accelerated by the Y interaction. I cannot say how many yin periods are needed to eject a negative loopon. The number might be one or it might be 100. That is the number I refer to as X. What I *can* say is that X will be the same for both PMTs if they are manufactured in an identical way.

Everything is in the timing. If both polarization filters are identically aligned, both PMTs will reach the number X at the same moment and there will be a coincident hit. If the transmission axis of each polarization filter is at 90° to the other, both PMTs will rarely reach the number X at the same moment. Table 6-1 predicts that a hit on one PMT will be matched by a coincident hit only one time in 180 registrations.

Sketch 6-12



If filter A remains fixed and filter B is adjusted to 89°, obviously the model predicts that the probability of a coincident hit will be greater than .00555 and greater still if filter A remains fixed and filter B is adjusted to 88°. This process can continue with the value of θ being consistently reduced, degree by degree, until it reaches 0° and the probability of a coincident hit is 1.00000. The question now becomes: Will the incremental changes in probability be strictly linear [$P = 1/180 + 179/180 (1- \theta/90)$] or will they be curvilinear [$P = COS^2\theta + 1/180(\theta/90)$]?

Again, I appeal to the logic offered in Sketch 6-7. Because the incremental changes in the angular difference between the transmission axes of polarization filter A and polarization filter B drive incremental changes in the areas of the momenton fields allowed to pass those filters, the cosine square relationship is the proper choice for making coincidence predictions for the continuum of adjustments proposed in Sketch 6-12. **Therefore, given 0º ≤ θ ≤ 90º, when both SPU CH74 polarizers are set to any angle, when PMT A records a hit, the probability (P) of a hit on PMT B is:**

$$P = COS^2\theta + .00555(\frac{\theta}{90}) \qquad \text{(Equation 28)}$$

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1 The capstone test demonstrating the failure of Bell's inequality is called "the Aspect experiment," after the 1982 contributions of Alain Aspect, Jean Dalibard, Gérard Roger and others at the Institute of Optics of the University of Paris. The complexity of this experiment is best followed by first reading Aspect, A. et al. (1981). Experimental tests of realistic local theories via Bell's theorem. *Physics Review*, *Letter 47*, p. 460 and then Aspect, A. et al. (1982), Experimental test of Bell's inequalities using time-varying analyzers, Physics Review, Letter. 49, p. 1804.

2 See Bell, J. S. (1964), On the Einstein-Podolsky-Rosen paradox. *Physics 1*, 195-200

3 Clauser, J. F., Horne, M. A., Shimony A. & Holt, R. (1969) Proposed experiment to test local hidden-variable theories, *Physics Review, Letter 23*, p. 880

4 See Aspect, A. et al. (1982). Experimental realization of the Einstein-Podolsky-Rosen-Bohm gedankenexperiment: A new violation of Bell's inequalities. *Physics Review, Letter 49*, 91

5 Shimony, A (1988, January) The reality of the quantum world, *Scientific American 258.* p. 48

6 Ibid.

7 Philosophy students will find undergraduate textbooks in physics cover this. My introduction to circular polarization came from Sears, F. W., Zemansky, M. W., & Young, H. D. (1974). *College Physics*, Reading, MA: Addison-Wesley Publishing Company. pp. 691-692

7

Three-dimensional Time in the SPU

7.0 Overview

This chapter is a reflection on the meaning of time in the SPU. Pragmatic physics is anthropocentric. In our physics, the variable for time (*t*) can only be what it is to the continuum of experience. But, at the Planck scale there are no observers. So, what is the meaning of time to an electron?

7.1 The Kantian Tone in Our Current Interpretation of Time

In his *Critique of Pure Reason* Immanuel Kant essentially argued that our interpretations of experience cannot be more than what the reasoning processes of the human mind allow it to be. In short, physics is by nature anthropocentric. Contemporary pragmatism demonstrates Kant's insight. Kant's only error was to fail to recognize, as I pointed out in my doctoral dissertation, that his own analysis of the problem tells us that experience is inherently stochastic. [1] Our applied physics works well and there is no reason to change it. But, the boundary between applied physics and etiological physics is not always recognized.

We denounce, therefore on one hand, metaphysics and, on the other, practice it. When we assume nature, like experience, is stochastic, we are making a metaphysical assumption. For both the Taylor interference experiments and the Bell tests, a receiving screen event is said to be caused by a single photon. This is not an empirical claim; this is a metaphysical claim, a causal claim based on the assumption that light is not granular. How do we know that what I call the popcorn effect is not in play? We assume our descriptions of nature equate to the laws of nature and that distance, time, and mass are, at the Planck scale, the same as within experience. This is all very Kantian.

Kant particularly argued that our laws of nature can only be based on a concept of time that is linear and unidirectional. The idea of time reversal is usually, but not always, explored from the perspective that it is an arrow opposing the arrow of entropy time. In the SPU, time is intrinsic to the directon; it is "future" directed as positive directons and "past" directed as negative directons. In this sense, time defines the positive and negative nature of SPU quanta and antiquanta.

Yet this past and future is not entropy time. It is time as forward motion and reverse motion. Entropy time is simply the story of how their relational patterns evolve. Consider a large field populated by fifty symmetrical cars whose fronts are identical to their backs. Twenty-five enter the field in reverse and 25 in forward gear. Their speeds are variable. They start from a speed of zero and conclude with a speed of zero. If the matter of time is viewed from each vehicle's drive train, half the cars are going forward in "time" and half are going back in "time"; the net time is zero. If the amount of motion is used as the measure of "time", then while a car is accelerating, it is going forward in "time" and backward in "time" while decelerating; when coming to a stop, its net time is zero.

Finally, consider an observer using a drone high overhead. The observer can make no distinction between those cars in forward gear and those in reverse. From her perspective, all are in forward gear. All observed acceleration and deceleration is viewed within a continuum defined by the evolution of changes in the relative positions of the cars on the field. For the observer, the velocity of time can only accelerate or slow if all cars are simultaneously accelerating or slowing. Such coincidences rarely occur.

Hence, for the observer, the velocity of time is in her mind's continuum of experience, one that can only be defined by the rate at which her mind sequences that which is being observed. Time can only be demarcated into fixed durations by comparing a recurring cyclical event with other changes.

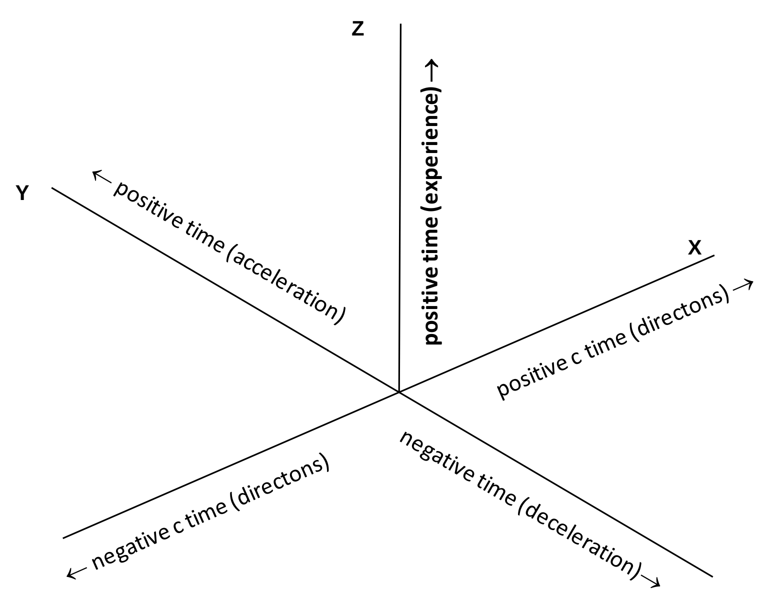
7.2 The Basic Idea of Three-dimensional Time

Descartes was born into a world where height, depth, and width were considered to only have positive values. The value "zero" was placed at the left end of the measurement continuum, not in the middle. Descartes suggested we might make progress in our understanding of things if we placed the value "zero" at the center of the measurement continuum of each. Relativity theory is a fruit of this suggestion.

This model invites us to do the same with time. For us, time is marked by relational changes within experience. We all realize that the variable *t* in our descriptive equations is, in part, subjective. The motion of photons and subatomic particles can be defined by distance concepts for the pragmatic purposes of an observer, but their "speed," as it is in itself, is driven by a more fundamental principle. Yes, we humans can measure the speed of light using time as defined by a particular hyperfine energy level transition in cesium-133 and distance as defined by a wavelength of light emitted by krypton-86; but a photon's intrinsic speed is not a function of these constants or others like them.

The upshot is that loopon acceleration, by creating speeds less than *c*, brings to the SPU a new set of possible values for the velocity of change and hence, a second time dimension to the SPU. Accelerated subatomic particles are influenced by, but otherwise indifferent to the larger particles of which they are a part. Only a conscious observer has the ability to see the patterns formed by trillions of loopons interacting through attractive and repulsive forces. Hence, light operates in positive and negative *c* time. Particle acceleration and deceleration function in sub-*c* time. Conscious experience merges both into a unidirectional continuum that is perhaps best called entropy time.

THREE DIMENSIONAL TIME IN THE SPU



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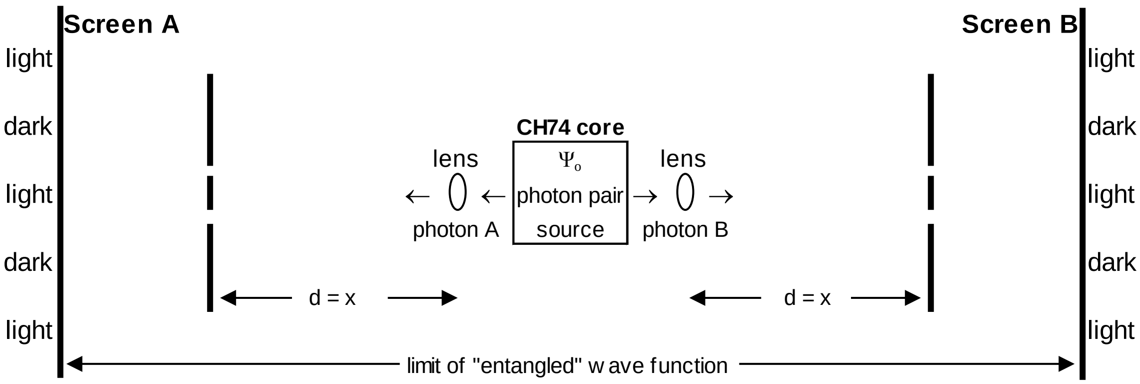
[1] Cale, David. *The Kantian Element in the Copenhagen Interpretation of Quantum Mechanics*, Ann Arbor: ProQuest Books, 2002. p. 61

A TEST FOR THE FAILURE OF NON-LOCALITY IN THE CH74 EXPERIMENT

Underlying our interpretation of Bell tests is the belief that light is not granular. Underlying our belief that light is not granular is the assumption non-de Broglie particles cannot exhibit interference. The SPU model finds a time symmetry at the Planck scale that allows granular photons to exhibit interference. The SPU model for light replicates the outcome of the CH74 experiment and predicts Bell test non-locality will fail in the experiment outlined below. This test, therefore, can be used to credit or discredit the SPU model.

STEP ONE

Use the core of the CH74 device to create "entangled photon" states. Replace the polarization filters & PMT tubes with Taylor's two-slit apparatus. Over time, the expected interference bands will appear at both screens A & B. Both the standard interpretation and the SPU photon model can explain the bands.



STEP TWO

Replace the A side of the experiment with a photon detector at a distance of .5x from its lens and repeat the paired photon emissions. The standard interpretation predicts the observation of the "entangled" wave function will collapse all probabilities within it. Thus photon B will be determinate before reaching the slits and interference patterns on screen B must cease. The SPU model predicts events on side A of the experiment will have no effect on side B and its local granular driven interference patterns will continue.