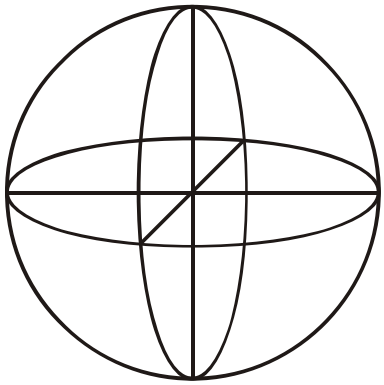
The Mathematical and Scientific Application of The Modular Form



• The Modular Form as the Unrecognized Basis for the Primary Operations of Mathematics

• The Simple Constructive Proof for Fermat's Last Theorem

• Derivation of the Masses for the Proton, Neutron, and Electron to Five Decimal Places, in Exact Agreement with Experiment

• The Prime Numbers and the Derivation of the Electron Orbitals and Electron Shells of the Atom

MARK PROVO

Contents

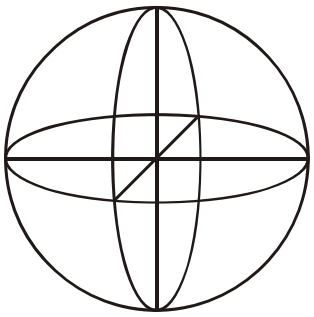
Introduction to the Modular Form

Truth can be recognized by its simplicity and its beauty.

Richard Feynman

This book provides an introduction to the Modular Form, a simple geometric structure that makes all of the mathematics it generates observable in an actual model or diagram. That is, the observer can hold an actual model of the Modular Form in his or her hands, and can observe every mathematical state within the system of mathematics that this geometric structure makes possible. Further, the observer becomes part of the mathematical system, in combination with the Modular Form. It turns out that the laws of nature operate directly from this mathematical system. It is the previously unrecognized system of **Observer Mathematics**. The Modular Form looks like this:

The Modular Form



We should always examine our systems of thought to make sure that simple insights have not gone overlooked. When this process is applied to mathematics and science, the result is the discovery of multiple oversights, in both disciplines. This has resulted from the increasing emphasis on abstraction (and hyperabstraction) in mathematics and science.

Among academic physicists, the current way of conceiving physics is that the universe exists as a "four-dimensional hyperspace," a state that is immediately realized by any person to be abstract, and nonobservable. No person can picture, and no computer can draw, four right angles existing together at a single point. [Look upward at the corner of the room where the walls meet the ceiling. We see three lines meeting at right angles to each other (the usual dimensions X, Y, and Z), but where would a fourth such line go?] We are told that the very existence of the universe is such that its actual nature cannot be seen by anyone, ever, and that it can only be conceived in the mind as a mathematical abstraction in which four right-angle dimensions are somehow real. But is that how the universe *actually* is?

Should the universe turn out to be this way it would be extremely disappointing, because to remove observability from mathematics means that, (1) we must exclusively rely on abstract mathematical forms for understanding, and (2) as human beings we cannot enjoy the direct observation of how the universe works. If we seek to hold the aesthetic criterion that truth should be simple, elegant, and beautiful, we must immediately recognize that this hyperspace picture makes that criterion impossible. The key question is whether we may have overlooked something which shows that this *interpretation* of the four-variable mathematics is in error. I have discovered that such an oversight has in fact been made.

The key mathematical discovery that revolutionizes our understanding is the simple mathematical state which I call **The Modular Form**. This state is comprised of a sphere that has another small sphere of actual size at the center. It has three disks of thickness, with interior region, that intersect at right angles (that is, they are orthogonal). It also has three orthogonal linear axes which are actually cylinders. The three primary geometric states are *sphere*, *disk*, and *cylinder*.

The Modular Form is the very beginning of mathematics. We discover immediately that the entire structure of basic mathematics had not even been discovered. We will see here, in part one, that arithmetic and algebra actually originate in the Modular Form, as do the trigonometric operations, the hyperbolic operations, logarithms, differentiation and integration, and the previously unrecognized operators of expansion and contraction. We discover a stunning organizing pattern that unifies all 29 of the primary mathematical operations into a single state. This organization is provided by the Modular Form.

We also discover that there are *two* different axis systems for variables. The first system has X, Y, and Z, for patterns of *sequence*, while the second contains X, Y, Z, and T, for *geometric length*, in a way that allows four variables to exist on three axes.

Because of the increasing emphasis on the wave nature of phenomena, the idea that the sphere is actually the basis for particles and atoms is strangely dismissed or ignored. The new understanding shows the major role that the sphere plays in determining virtually all physical patterns and properties. This understanding is greatly needed in physics.

We then become aware of the major application of the Modular Form to algebra, which is that the real structure of algebra immediately provides the simple, constructive proof for Fermat's Last Theorem. This theorem, left to posterity in a note written in the margin of a book by the French mathematician Pierre de Fermat in the seventeenth century, is the most famous problem in the history of mathematics. While a highly abstract proof-by-contradiction for the theorem was found in 1994, the real explanation for why this simple theorem is true has eluded everyone for over 360 years. The simple proof for Fermat's Last Theorem is found in part two here. It depends on the Modular Form.

The third paper, found in part three, provides the derivation of the masses for the proton, neutron, and electron, to five decimal places, in exact agreement with experiment. This derivation occurs within the mathematics of the Modular Form. It should be noted that no derivations for the constants of nature have ever been found, as indicated by Professor John Barrow of Cambridge University in his 1994 book *The Origin of the Universe*:

> [A]lthough these constant quantities appear in all our laws of nature, they are root the deepest mystery about the structure of the universe. *Why* do they have the particular values they do? It has always been the goal of physicists to come up with some complete theory of physics in which the values of the fundamental constants are either predicted or explained. Many great scientists have tried; all have failed to make any headway with this problem. (pp. 106-7)

This point was also made by Professor David L. Goodstein of the California Institute of Technology, host of the television series *The Mechanical Universe* (in the program he is shown lecturing to a physics class at Caltech):

> [Y]ou might wonder what really would constitute a great scientific discovery; what is the sort of thing that would make scientists sit up and take notice? Well, let me give you an example. There are certain fundamental constants of nature. For example, remember there is G, the universal constant of gravity, which is equal to 6.7×10^{-8} dyne cm^2/gm^2. Or there is the speed of light. The speed of light is equal to $3x10^{10}$ cm/s . . . . These quantities, and others like them, completely govern the nature of the world that we live in. If any one of these quantities was different in magnitude from what it is, the world would be completely different from what it is. And yet, we have no idea of why any one of these quantities has the size that it does. (Episode: *Gravity, Electricity, & Magnetism*)

The fourth paper, found in part four, demonstrates that the electron orbitals and electron shells of the atom are determined by patterns of the prime numbers. It also shows that 1 is a prime number for nature. This overall electron structure originates in construction based on the Modular Form.

What you are about to read changes everything for our picture of both mathematics and science. The samples provided here are just the beginning of an entire body of understanding that explains how all of the laws of nature actually work, and how all of the constants of nature are derived. Everyone should prepare to be astounded.

There is currently a major movement in academic physics to view the universe as being based in "superstring theory," "M-branes," or other related hyperabstract structures (in which it is claimed that the universe has 10, or 11, or 26 dimensions, and so on). I can state unequivocally that none of this is true in any way whatsoever. These ideas are completely imaginary and have nothing to do with the actual universe.

The presentation occurs in four parts, each a distinct scientific paper:

Part One

The Modular Form as the Basis for the Primary Operators of Mathematics

Part Two

The Simple Proof for Fermat's Last Theorem

Part Three

Derivation of the Masses for the Proton, Neutron, and Electron

Part Four

Prime Numbers and the Electrons of the Atom

This book has been prepared for the mathematical and scientific communities, but is also accessible to educated nonspecialists. The only background required is a general sense of mathematics and science. Everything explained here can be completely understood even by high school students. My hope is that it will be widely read by high school teachers, high school students, college instructors, college and university students, university professors, and other specialists in government, business, and industry. I ask that all mathematics and science departments read the book as a group and discuss it thoroughly. A full redevelopment of both disciplines must occur, and that process begins with this presentation.

It is important to emphasize, however, that most ordinary people can come to understand these papers, with a little study and conversation. The exciting thing about this work generally is that it restores clarity and understandability to mathematics and science, and makes the provable truth about how the universe *actually* operates available to everyone. This will become even more true as the full body of new material, discovered by me over the past ten years but unpublished until now, is made available in proper presentation form (including books, computer programs, and animation on video).

A note about part three: The third paper, on the derivation of the masses for the atomic particles, is accompanied by a preprinted flowchart that shows the diagrams from the paper, as an aid to understanding. This flowchart appears just before the paper. Those two pages should be removed, and could be taped together to form a single flowchart form. Refer to the flowchart as you read that paper.

We begin by discovering the Modular Form and its applications, in part one.

Part One

The Modular Form as the Basis for the Primary Operators of Mathematics

The Modular Form as the Basis for the Primary Operators of Mathematics

MARK PROVO

ABSTRACT

The Modular Form, a sphere containing three orthogonal disks with thickness and three orthogonal cylinders, is shown to be the basis for all of the fundamental operations of basic mathematics. The operations of algebra and arithmetic, the trigonometric operations, the hyperbolic operations, logarithms, differentiation and integration, and the (previously unrecognized) operators of expansion and contraction are all seen to result from their common origin in the Modular Form. Application of the Modular Form to physics is also discussed. One of these physics applications provides proof that the claimed "four-dimensional spacetime" of modern physics, with four orthogonal axes, does not exist. Another is the discovery that gravitation is actually a force of *contraction*, and is paired with the cosmological force, a force of *expansion*. All forces of physics are found to be forms of either expansion or contraction, and to be based in the Modular Form.

Our Mathematical System is Actually Based in Observation

In the history of mathematics, essentially no attention has been given to the mathematics of the observer. Such a system is real, however, and is discovered to exist as the actual basis for the creation and laws of the universe. This unrecognized mathematical system, **Observer Mathematics**, creates a major change in how we should view both mathematics and science. The understanding shows that many incorrect assumptions about how to start and do mathematics have created a false foundation for it. It further shows that mathematics and the universe go together, automatically, in a way that is simple, elegant, and beautiful. Instead of being a "mere theory," Observer Mathematics provides *proof* for its actual existence in the universe (by directly deriving the values of the constants of nature, and by answering all of the outstanding questions of cosmology, physics, and more).

Notice that when one learns mathematics as it is currently conceived, the experience is one of learning a list of definitions and studying various mathematical techniques used to solve problems (for example, the course instructor says, "One operation of arithmetic is division, and here is how you perform division . . . ."). What we learn is apparently consistent, but we are left wondering how it all originates in the first place. What is it that both originates and unifies all of basic mathematics, from arithmetic to calculus? Where does *mathematics* come from? The initial answer to this question will be provided here, and as we will see, everything is about the observer.

To begin the development of the system of Observer Mathematics we begin with an **Intelligent Awareness**. You can model this yourself by sitting still and quietly thinking; aware, intelligent. This is the single state origin of the system:

The First Step of Construction

1INTELLIGENT AWARENESS

Note the appearance of whole number one, **1**, in the name. Mathematically, Intelligent Awareness *is* **Whole Number One**, the actual basis for mathematics. This state is not a "point" on a line, but a whole substantive medium.

As the scientific papers of this book proceed we will discover that there is a crucial difference between the state *whole number one*, **1**, and the state *positive one*, **+1**. Physics cannot be understood without this distinction.

The second step of construction becomes a *dual hierarchy*, in which Intelligent Awareness becomes Observer senior to an observed:

OBSERVER

OBSERVED

The Observer is the one who determines steps of mathematical construction. The Observer is seen as being outside and above the sphere, just as you would be when holding a basketball in your hand and looking down at it. The first state observed by the Observer is a **Sphere**:

The Second Step of Construction,
The Original Dual Hierarchy State

OBSERVER

SPHERE

This original sphere state is not centered (the abstract center proposed by the current mathematical tradition could not be observed).

There are two experiences for the Observer. The first is *thought*, and the second is *observation of the geometric object*. The Observer creates a chalkboard upon which the mathematics is written, expressing the thought in writing. The Observer is either observing the object, or thinking and writing thoughts on the board. This is again a state which you can personally duplicate.

The next form of the sphere results from adding a centering state (another small sphere of actual size) to the uncentered sphere:

The Third Step of Construction,
Centering the Sphere

OBSERVER

CENTERED SPHERE

The fourth step in construction is for the Observer to construct three circular disks at right angles to each other, around that centering sphere. The width of each disk just contains the centering sphere. Each disk is a shell boundary, with an interior state that is either *empty* or *full*. We write it like this:

The Fourth Step of Construction,
Constructing Three Orthogonal Disks

OBSERVER

CENTERED SPHERE

THREE ORTHOGONAL DISKS

The Observer then sees that the intersection of these three disk/shell states creates three square tubes that intersect at the centering sphere. This provides a location for the final step of construction. The Observer adds three cylinders to the interiors of these square tubes, creating three orthogonal axes, summarized as follows:

The Fifth Step of Construction,
Constructing Three Orthogonal Cylinders
and Completing the Modular Form

OBSERVER

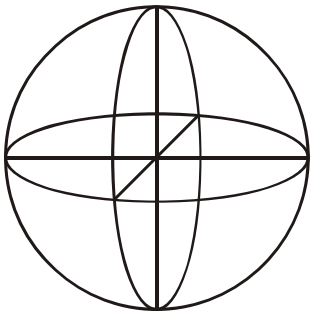
CENTERED SPHERE

THREE ORTHOGONAL DISKS

THREE ORTHOGONAL CYLINDERS

It is this final state that the Observer labels as **The Modular Form**. This is a process of ordered construction with five steps, now completed. The Modular Form looks like this:

The Modular Form



Number and other mathematical states will reside on the sphere, or within the disks and cylinders of the Modular Form.

The First Application of the Modular Form

So far we have a single constructed state, the Modular Form. This first state is established as the original *ordered construction*, which acts as the primary basis:

THE MODULAR FORM
(Original Basis State)

The Observer now views the Modular Form and analyzes what can be mathematically developed from it, writing any thoughts and observations on the chalkboard. New derived states will appear as *ordered applications* of the Modular Form.

The first thing the Observer writes on the board is the following counted dual hierarchy:

1 THE MODULAR FORM

2 *Noun* *Verb*

The states *noun* and *verb* are important ingredients in Observer Mathematics. Combining the Modular Form with each of these two categories creates:

THE MODULAR FORM (Noun)

THE MODULAR FORM (Verb)

The noun form is the distinct basis for *ordered application* (identical to the original, but also distinct). The verb form is the ordered application where the Modular Form becomes an active *calculator*:

THE MODULAR FORM AS BASIS FOR APPLICATION

THE MODULAR FORM AS CALCULATOR

The calculator form uses the three disks to calculate changes of state according to forms established by the Observer. The pattern is:

DISK A: Input
DISK B: Operator
DISK C: Output

Every change of state in physics is created from this calculator. We will see the direct application of this calculator when it is used to derive several constants of nature in the paper of part three.

The flow of patterns constructed so far is as follows:

THE MODULAR FORM
(Original *Ordered Construction* Basis State)

THE MODULAR FORM AS BASIS FOR ORDERED APPLICATION

THE MODULAR FORM AS CALCULATOR

Note that the first entry is "one level" while the second entry has two levels. The next state will have three levels.

The Second Application of the Modular Form

To construct new states the Observer views the primary interior of the Modular Form as a mathematical union:

THREE DISKS U **THREE CYLINDERS**

The Observer separates the two categories so that they can also be seen to exist independently. The overall structure becomes the following triple hierarchy:

THREE DISKS U **THREE CYLINDERS**

THREE DISKS ONLY

THREE CYLINDERS ONLY

The Observer now counts the levels (counting will be further explained in the paper of part three), as follows:

1	**THREE DISKS** U **THREE CYLINDERS**
2	**THREE DISKS ONLY**
3	**THREE CYLINDERS ONLY**

This becomes the basis for the second application of the Modular Form, in which each of these states is seen to exist within a sphere, viewed by the Observer:

The Second Application of The Modular Form

OBSERVER	
1	**SPHERE WITH THREE ORTHOGONAL DISKS AND CYLINDERS**
2	**SPHERE WITH THREE ORTHOGONAL DISKS**
3	**SPHERE WITH THREE ORTHOGONAL CYLINDERS**

This *downward* array is now seen as the *ordered construction* that will precede an *ordered application*, flowing *upward*. That application will create the 29 operators of basic mathematics, including two previously unrecognized.

The array shows that the Observer will construct three applications of the sphere with three orthogonal cylinders (the bottom line above). The first of these will be the XYZ-Axis System, where we obtain three sets of opposite variable states, arranged hierarchically, from the bottom up:

The First Sphere with Three Axes,
The Basic Algebraic Variables

-Z / +Z
-Y / +Y
-X / +X

The numbers proceed along these axes as *forms of sequence*. Geometric length appears on a different axis system, derived below. The center state can provide **0** if that is chosen.

The array shows that there will be two more forms like this, with three sets of opposite states arranged on three axes. The Observer assigns to these two types of operators.

The first type of operator is the *operation of comparison*, of which there are six, in three sets of opposite states, arranged hierarchically from top to bottom:

The Second Sphere with Three Axes,
The Type 1 Operators of Comparison

$= / \neq$
$< / >$
$\leq / \geq$

Mathematicians and scientists have never viewed these statements as being operators, and this is a fundamental oversight. The six forms shown above are operators of comparison, a key act performed by the observer. This becomes especially important relative to Fermat's Last Theorem, as explained in the paper of part two.

The second type of operator is the *operation of algebraic/arithmetic combination*. There are six such operators of combination, in three sets of opposite states (addition/subtraction, multiplication/division, power/root), arranged hierarchically from bottom to top:

The Third Sphere with Three Axes,
The Type 2 Operators of Combination

---

p / r
$\times / \div$
+ / -

The order of operations results from then flowing downward in this structure. This raises an interesting point. The current way of explaining operations in arithmetic is that there are "four fundamental operations," listed as addition, subtraction, multiplication, and division. Here are samples from two mathematics websites which contain information about this:

> 1. Arithmetic is the branch of mathematics concerned with the study of numbers and their properties. The fundamental operations of arithmetic are addition, subtraction, multiplication, and division. Raising to powers, the extraction of roots, percentages, fractions, and ratios are developed from these operations.
>
> 2. **Operation:** The basic operations of arithmetic are addition, subtraction, multiplication, and division.

Both of these statements are completely incorrect. There are *six* basic operations in arithmetic, not four. This fact must be immediately seen in relationship to the order of operations. Those steps use the very hierarchy shown above,

p / r
× / ÷
+ / - ,

in downward order, as the operations are encountered left-to-right. One would not add percentages or ratios, as other categories, to this structure. The first website statement above says, "The fundamental operations of arithmetic are addition, subtraction, multiplication, and division. Raising to powers, the extraction of roots, percentages, fractions, and ratios are developed from these operations." Are all of the listed patterns of this statement to be seen as occupying the same status when powers and roots affect the order of operations but percentages and ratios do not? Is this classification system of the different mathematical categories correct? It is not. There are six fundamental operations.

This completes the bottom row of the array.

The Observer now moves upward to the second line of the array to construct two forms of the sphere with three disks only. Here, the dual hierarchy

$$\frac{\mathbf{A}}{\mathbf{B}}$$

is applied in two ways (the dual hierarchy will be fully explained in the paper of part three). The first application occurs when the dual hierarchy pairs sides of the right triangle, to create the Trigonometric operators in three sets of opposite states:

The First Sphere with Three Disks,
The Trigonometric Operators

SinA / CscA
CosA / SecA
TanA / CotA

These states appear on the front and back faces of the disks (actually, there are two disks in each case, one on top of the other, creating the two faces; further details about the nature of the disks of the Modular Form will be provided in the paper of part three).

The second sphere of line two again applies the dual hierarchy construction to create the six hyperbolic operators (involving e^x and e^{-x}), in, again, three sets of opposite states, on the front and back disk faces:

The Second Sphere with Three Disks,
The Hyperbolic Operators

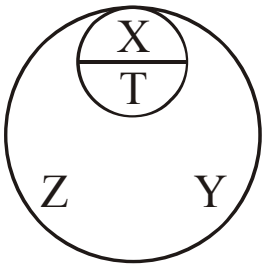
SinhA / CschA
CoshA / SechA
TanhA / CothA

The Observer then moves to the top line, containing a single Modular Form state with three disks and three axes. We note here the appearance of a further axis system, distinct from the ones of the bottom row. This becomes the basis for the four Space/Time variables X, Y, Z, and T. We will discover that the whole system we call "mathematics" contains physics patterns *from the beginning*.

To discover how this new axis system is developed we follow the construction of this new system, in order. The first state is the **X** axis. The Observer then constructs the **Y** axis orthogonal to **X**, followed by the **Z** axis orthogonal to **Y**. A fourth variable, **T**, would then be orthogonal to **Z**, but this is not possible unless we return to **X**. We discover that this sequence is *modular*. What we thought was a linear sequence of variables,

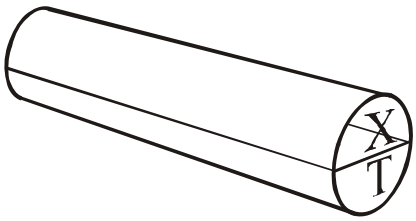
X Y Z T

is actually modular (where the top sector contains the first and last elements):



This means that **X** and **T** share the same axis. Note that this is not possible with the usual conception, basic to current mathematics, that an axis must be a line with no actual size. We discover that there are two kinds of lines. The first is a cylinder, which in one application becomes the vector, and the second is an "etching," used primarily by the observer to do graphing, and to create calculus (there is more about this on page 19). The dual assignment of variables seen above is why we must have a cylinder for the axis. The **X**-axis cylinder is partitioned into an upper half portion and a lower half portion by a plane, with **X** residing in the upper half and **T** residing in the lower half:

The Actual Nature of the X Axis is X/T



Note that this places **X** over **T** in a dual hierarchy, giving:

$$\frac{\textbf{X, Distance}}{\textbf{T, Time}}$$

This immediately becomes velocity, **V**. The details of how all of this produces motion will appear in a future publication. Those results are stunning.

As a note, it should be obvious that *time flows along the path of motion, as part of velocity*, another primary reason that T cannot be seen as being orthogonal to XYZ.

Aside: Formal Construction of X, Y, Z, T,
and Why "Four-Dimensional Spacetime" Does Not Exist

The current picture of the universe held by essentially all modern physicists is that it exists as a four-dimensional state called "spacetime." This idea was arrived at through the following incorrect reasoning: We require three right-angle dimensions X, Y, and Z, to locate a position in space. Place a particle at such a point. We write the ordered triple (x,y,z) for that point relative to a coordinate system we have selected. To observe change of state for the particle, time must be included in the system. To compare motion between two points requires that for each point we be able to identify the position, (x,y,z), as well as the time, t, when the particle is found to be there. Scientists then viewed this added time dimension as also being right-angle orthogonal relative to the XYZ-coordinate system, even though such a four-dimensional state cannot be observed or even imagined.

An uninspected assumption occurred at this point. It was assumed to be impossible for the time dimension to be seen in some other way, such that it does not force an unreal and nonobservable coordinate system onto the universe. As shown above, however, the Observer distributes this time "dimension" in a different way than making it orthogonal to XYZ, precisely because such orthogonality cannot occur. Instead, time T coexists with X on the first cylinder axis. *There are no "higher spatial dimensions."*

For Observer Mathematics, the actual mathematical system of the universe, all mathematical states must be created by formal construction. Everything that is real must be constructed in ordered steps as determined by the choices and logic of the Observer.

The three primary geometries of Observer Mathematics are:

Sphere
Disk
Cylinder

These states determine the nature of construction for all patterns related to "dimensionality" and "orthogonality." Those steps occur in a downward array of four states, followed by an upward array of four states. The eight steps are as follows:

Construction of Dimensionality and Orthogonality, Step 1

SPHERE
(Uncentered)

In this step the Observer constructs a sphere that is not centered. In Observer Mathematics, *boundary precedes center by a full step*. [A helpful example of centering is in the cylinder, which is at first uncentered. One way of centering the cylinder leads to another small centering cylinder running lengthwise inside. For motion, this cylinder is the residence of the arrow (direction) aspect of a vector. (This center is in the frame that views the cylinder from the end, seeing the circular cross-section and the circular center.)]

The next step in this construction is to add the circular disk, at the equator:

Construction of Dimensionality and Orthogonality, Step 2

SPHERE
DISK

This disk is not centered either. We now add the cylinder, which exists inside the disk, running in the X direction:

Construction of Dimensionality and Orthogonality, Step 3

SPHERE
DISK
CYLINDER

This cylinder can be named X, and is also not centered.

It is only now that a centering sphere is added to this overall structure:

Construction of Dimensionality and Orthogonality, Step 4

SPHERE
DISK
CYLINDER
CENTERING SPHERE

Notice that this centering sphere can act as the center for the sphere, the disk, or the cylinder, depending upon the application.

This completes the four downward steps. The next four steps proceed upward from this basis.

The first step is the application of the above state, in which the Observer views the cylinder *as being centered by the centering sphere*. This is the X state, now split into -X and +X (the details of how 0 works in this will be omitted here, but it is present):

Construction of Dimensionality and Orthogonality, Step 5

SPHERE
DISK
CYLINDER (-X / +X)
CENTERING SPHERE

The disk provides the first opportunity to have joined, orthogonal cylinders. Adding a new cylinder Y, inside the disk and also centered by the centering sphere, creates the first appearance of orthogonality.

Construction of Dimensionality and Orthogonality, Step 6

SPHERE
DISK
CYLINDER (-X / +X)
CENTERING SPHERE
CYLINDER (-Y / +Y)
ORTHOGONALITY PRESENT

The Observer now views the centering sphere as being the center of an added cylinder, Z:

Construction of Dimensionality and Orthogonality, Step 7

SPHERE
DISK
CYLINDER (-X / +X)
CENTERING SPHERE
CYLINDER (-Y / +Y)
ORTHOGONALITY
CYLINDER (-Z / +Z)

The final step is to add the T variable. As shown earlier, this state cannot be orthogonal to Z such that there are four orthogonal axes, and is therefore assigned to the X cylinder, from the modular basis shown on page 14. This creates the following, with T appearing in the third line:

Construction of Dimensionality and Orthogonality, Step 8

SPHERE
DISK
CYLINDER (-X/T / +X/T)
CENTERING SPHERE
CYLINDER (-Y / +Y)
ORTHOGONALITY
CYLINDER (-Z / +Z)

Without this construction, how would X and T be brought together to make velocity? Remember, everything has to be *constructed*.

We see the immediate implication of the results outlined here for physics, which is that the claimed "four-dimensional spacetime," with four orthogonal dimensions, does not exist. This further implies that the geometric interpretation of the mathematics of Einstein's General Relativity, the current model of gravity, is not real. There is no "warping" of a "four-dimensional substance" called "spacetime." General Relativity, which has correct calculations, requires a different physical picture. (The equations of General Relativity actually reside as states on the circular disk, but explaining those details here would be beyond the scope of this introduction.)

The first cylinder axis system of the third row in the array, containing only X, Y, and Z, is a *noun* state (it will be used for Fermat's Last Theorem in part two). The second axis system, with X, Y, Z, and T, is the *verb* form, allowing action, and therefore physics.

There are now three disks remaining in the top row form. The first disk contains the exponential operator as it relates to the logarithm operator. Notice that in the algebraic/arithmetic operators of the bottom row (page 12), the top row for sphere three is:

Power / Root

The root operator applied to the power operator returns the base. The logarithm operator returns the exponent. This distinct form appears in the first disk of the top row state, as an opposite states form:

The First Disk for the Top State,
The Exponential and Logarithmic Operators

$$\mathbf{A^x \,/\, \log A^x}$$

Within the application of this state the Observer derives the value for *e* and then creates the specific application $\mathbf{e^x \,/\, \ln e^x}$.

The second disk contains two overlooked operators that are fundamental to physics. These operators are ***expansion*** and ***contraction***. These forces first originate in the sphere, which expands or contracts. A secondary application to the cylinder, which either lengthens or shrinks the cylinder, is also automatic. Each of the forces of physics is discovered to be either a form of expansion (positive acceleration) or a form of contraction (negative acceleration). Here are three examples, paired as follows:

FORCES OF EXPANSION	FORCES OF CONTRACTION
COSMOLOGICAL (Positive Acceleration)	**GRAVITATION (Negative Acceleration)**
MAGNETIC A (Signs N/S Same)	**MAGNETIC B (Signs N/S Opposite)**
ELECTRIC A (Signs +/- Same)	**ELECTRIC B (Signs +/- Opposite)**

The usual description of gravity, for example, is that it is a force of "attraction," when it is actually a force of contraction. The same is true for magnetic and electric forces when the "signs" (N/S and +/-) are opposite. Magnetic and electric "repulsion" ("signs" the same) is actually expansion. Gravity is negative acceleration, and so it should not be surprising that there will be an opposite state force paired with it, having positive acceleration. This was discovered recently when the galaxies were found to be expanding outward with positive acceleration (the "cosmological force"). All physics forces operate from the two opposite state operators of *expansion* and *contraction*, originating mathematically on the second disk state:

The Second Disk for the Top State,
The Operators of Expansion and Contraction

Expansion / Contraction

The final opposite state operators are the two operators of calculus, *differentiation* and *integration* (antidifferentiation):

The Third Disk for the Top State,
The Operators of Calculus

Differentiation / Integration

In summary for the top state, we again have three sets of opposite states:

The Three Disks of the Top State

A^x / log A^x
Expansion / Contraction
Differentiation / Integration

We can now summarize the contents of the full array. There are two axis system forms (sequence and geometric length) and 29 operators (there would be a final count of 30 operators, but the power form appears twice):

Opposite State Operators as
the Second Application of the Modular Form

OBSERVER

A^x / log A^x
Expansion / Contraction U **XYZT Coordinate System**
Differentiation / Integration

SinA / CscA	**SinhA / CschA**
CosA / SecA	**CoshA / SechA**
TanA / CotA	**TanhA / CothA**

-Z / +Z	= / ≠	**p / r**
-Y / +Y	< / >	× / ÷
-X / +X	≤ / ≥	+ / -

This structure reveals another important fact which is that, for the Observer, algebra precedes arithmetic. The general definitions for the algebraic/arithmetic operations come first, and then specific values for the variables lead to arithmetic calculations.

This structure automatically contains physics, and we discover that mathematics and physics originate together and become the universe. Mathematics has existential reality. Basic mathematics can no longer be viewed as an abstraction existing only in the mind.

This limits the number of orthogonal dimensions to three, and the number of primary physics variables to four.

The first major mathematical application of the bottom row of the above array is that it provides the missing basis for directly proving Fermat's Last Theorem, as shown in the paper of part two. We discover that the reason the theorem was never proved in a simple way was because the very structure of algebra had not been discovered (except perhaps by Fermat himself, at least in part.)

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Part Two

The Simple Proof for Fermat's Last Theorem

The Simple Proof for Fermat's Last Theorem

MARK PROVO

ABSTRACT

The simple proof for Fermat's Last Theorem is provided. The proof is direct and constructive, and is shown to depend on the actual, but previously overlooked structure of algebra itself. The orthogonality of addition and multiplication is shown to be central to the construction.

It is impossible for a cube to be written as a sum of two cubes, or a fourth power to be written as the sum of two fourth powers, or, in general, for any number which is a power greater than the second to be written as a sum of two like powers. I have discovered a truly marvelous proof for this which the margin is too narrow to contain.

Pierre de Fermat, c. 1637
Marginal note written in his copy of
the book *Arithmetica* by Diophantus

The simple proof for Fermat's Last Theorem results from an overlooked pattern that can be discovered relative to the creation, by formal construction, of the equation type present in the modern statement of the theorem:

$$\mathbf{X^N + Y^N = Z^N}$$
has no nonzero integer solutions (x, y, z)
when the power N is greater than or equal to 3.

The key insight into the problem is to view it as being one about **equation types**, and about whether or not certain equation types can be constructed so that they are **valid** (that is, at least one set of three numbers can be found so that the constructed equation is true).

This proof is one that involves formal construction, and it provides new insights into the foundations of mathematics; insights which have remained overlooked since Fermat himself apparently realized them. The first requirement for this construction process is that every mathematical object be observable, and that it have a formal existence within the real three-dimensional space found within a sphere. So far, mathematics has only defined *numbers* on the three-dimensional axis system that can center space, but this is an incomplete understanding. The *structural operators* used to create algebra and arithmetic have such an axis existence also, as will be explained below. Assigning numbers to three

centered axes creates the three variables of real space, **X**, **Y**, and **Z**. It should be immediately noted that Fermat's Last Theorem involves exactly these three variables.

Two historical notes should be mentioned relative to this. The first is that Fermat was the original mathematician to extend analytic geometry into three-dimensional space. This means that he was thinking deeply about the algebraic and geometric patterns that can occur in real space. This appears to be the basis for his own proof of the famous theorem (it will become clear that there is only one foundational constructive proof for Fermat's Last Theorem). The solution to the problem, probably seen by Fermat, results from previously overlooked patterns that show how algebra and arithmetic actually originate in real space. The second historical note is the fact that Fermat is now thought to have written his marginal note in 1637, the same year that Descartes published his famous work on analytic geometry, linking Fermat's Last Theorem to analytic geometry a second time. There is a very real sense in which this was a hint regarding the solution.

That which is *observable* mathematics can actually be constructed in a model, and is created by an Observer of both the sphere and what the sphere can contain. Conceptions of how to proceed in determining what this mathematics should be must originate in Intelligent Awareness, as possessed by the Observer. For example, **the operation of addition**, expressed as **X + Y = Z**, involves three observed patterns:

1. Three distinct ***number*** categories exist (**X**, **Y**, and **Z**)
2. An **operation of *combination*** exists (addition, +)
3. An **operation of *comparison*** exists (equality, =)

Regarding points two and three of this list, we can say that an **operation** is a formal action (***to compare*** or ***to combine***), performed by the Observer.

To say that patterns 1, 2, and 3 listed above can all be observed means that they must all have a geometric "residence," chosen by the Observer for the purpose of mathematical construction. The sphere becomes the residence of the component elements for both algebra (general) and arithmetic (specific). The three component types listed above for the addition operation reside on distinct axis systems constructed in the space contained by the sphere. There are three axis systems centered in the sphere, but not coincident:

THE THREE COLORED AXIS SYSTEMS OF 3-SPACE IN THE SPHERE

RED 3-AXIS SYSTEM	**NUMBERS**
GREEN 3-AXIS SYSTEM	**OPERATORS OF COMPARISON**
BLUE 3-AXIS SYSTEM	**OPERATORS OF COMBINATION**

These operators are named specifically as follows (see page 21):

THE THREE COLORED AXIS SYSTEMS OF 3-SPACE IN THE SPHERE

RED 3-AXIS SYSTEM NUMBERS
GREEN 3-AXIS SYSTEM TYPE 1 OPERATORS
BLUE 3-AXIS SYSTEM TYPE 2 OPERATORS

We then list these as follows:

RED VARIABLES	GREEN OPERATORS (TYPE 1)	BLUE OPERATORS (TYPE 2)
-Z / +Z	= / ≠	**p / r**
-Y / +Y	< / >	× / ÷
-X / +X	≤ / ≥	+ / -

The red number axes each display signed integers. The green and blue operator axes have the *same* "value" everywhere in each unpartitioned semiaxis (e.g., +). The operators of comparison come first because we can write, for example, X = Y, without an operation like addition being present. This also precedes writing, for example, the expression X+Y, as construction is defined and performed by the Observer. The presence of both operator types then creates a statement like X+Y = Z.

It is crucial to notice the fundamental structure which all of these patterns share in common. *Each axis system creates three sets of* ***opposite states***. This means that our first task is to understand the patterns generated by the fact *opposite states*.

We begin by observing that number is first conceived in the awareness of the Observer, and originates in the act of counting. Whole numbers exist there without "signs" (+ or -). The set of **natural numbers** is the first to be created in this way. Then the Observer constructs mathematical states within the sphere. The first action in this regard is the construction of the three-dimensional axis system. It is from this action that ***opposite state numbers***, or what we call ***the nonzero integers***, are geometrically motivated. A centered axis line becomes directed from the center in two opposite directions. When the unsigned whole numbers originally conceived are then applied to the axis line, signed whole numbers, renamed as the nonzero integers, appear (0 may or may not then be added).

In the case where we let the sphere be of radius 1, each directed axis segment is either +1 or -1. We observe that for addition the sum of these opposite states is zero:

$$(+1) + (-1) = 0$$

We then find that for multiplication there are four possible results:

$$(+1) \times (+1) = +1 \qquad (+1) \times (-1) = -1$$
$$(-1) \times (-1) = +1 \qquad (-1) \times (+1) = -1$$

From this we observe that a summary conclusion can be drawn:

FROM THE BASIS OF SIGNED OPPOSITE STATES:

- ***The product of identical states is positive one***
- ***The product of opposite states is negative one***

We further observe that **0** and **1** are the opposite states of the unsigned (really, *presigned*) whole numbers. Combining them with signed numbers and the two operator types provides another crucial pattern. This results from placing these opposite states in a dual hierarchy, as follows:

OPPOSITE STATES IN A DUAL HIERARCHY

1	**ON**	**+1**	**YES**	**=**	**>**	**≥**	**+**	**×**	**p**
0	**OFF**	**-1**	**NO**	**≠**	**<**	**≤**	**-**	**÷**	**r**

Notice how this shows that all positive operators could be replaced with +1 and all negative operators could be replaced by -1, should it arise naturally in formal construction to do so. This will occur here as we develop the construction process.

Aside: Another immediate application of this arrangement can be mentioned. Notice that the chart can allow the following statement to be true: **-1 = 0**. This is what accounts for the absence of antimatter in the universe. The natural laws of creation contain mathematical pathways made possible by this chart (in the form $\mathbf{-1 \rightarrow 0}$ and $\mathbf{+1 \rightarrow 1}$). The first pathway eliminates antimatter particles from the macrocosmic creation of particles in the universe, while the second path establishes matter particles in space.

The next observation we can make is that relationships of right-angle orthogonality exist for signed numbers and for both types of operators:

ORTHOGONAL STATES IN ALGEBRA AND ARITHMETIC

±X⊥±Y
±Y⊥±Z
±Z⊥±X
=/≠⊥>/<
>/<⊥≥/≤
≥/≤⊥=/≠
+/-⊥×/÷
×/÷⊥p/r
p/r⊥+/-

The key insight is to note from the above facts that addition and multiplication must now be seen as orthogonal states, +⊥×, corresponding with the statement +X⊥+Y.

Given these facts we can now note the following:

A FUNDAMENTAL FACT OF ALGEBRA AND ARITHMETIC

For the nonzero integers, algebra and arithmetic both originate from the union of numbers and two types of operators, and are therefore created entirely from the union of opposite and orthogonal states in those three categories.

The deep lesson of Fermat's Last Theorem is that mathematics must include recognition of these fundamental patterns, and must apply them relative to the theorem in formal methods of construction.

It is necessary to add a comment regarding the two categories of algebra and arithmetic. It is usually conceived that arithmetic comes before algebra, and that we should view algebra as *the generalization of arithmetic*. This is somewhat incorrect, however. For the mathematical Observer, the defining of any operation is a generalizing action (motivated by specific examples), and is first formally conceived and expressed algebraically. Then, acts of arithmetic (by the Observer) result when specific solutions that satisfy defined and/or constructed algebraic relationships are calculated. *Algebra is the original, single general pattern established by the Observer to define the operation*, while *arithmetic is specific calculation performed by the Observer with actual numbers*.

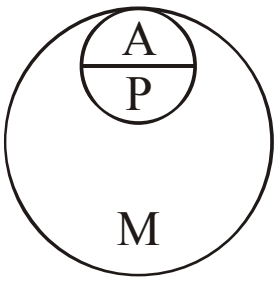
We can now begin to develop the specific pattern that leads to the full derivation of Fermat's Last Theorem. The process begins by more closely examining the structure of the equation statement itself. The statement $\mathbf{X^N + Y^N = Z^N}$ is a specific equation type: *three like powers in the addition relationship.* At a more basic level, however, we must observe that the structure originates within the original pattern of the positive type 2 operations in arithmetic (+, ×, and p), relative to the type 1 operator states = and ≠. The type 2 operations must be seen as being three sets of opposite states, arranged hierarchically such that repetition of a lower level results in defining a new operation, shown in the level immediately above:

POSITIVE OPERATIONS	**NEGATIVE OPERATIONS**
Power	**Root**
Multiplication	**Division**
Addition	**Subtraction**

The Fermat relationship is about the column of positive operators, relative to the construction of valid and invalid algebraic states. It may appear that only *power* and *addition* are represented in the Fermat equation, but this is because it is not being viewed *constructively*. The *multiplication* operation appears as the key step in construction (X^{N+1} results from the multiplication of X^N by X^1). It turns out that the multiplication operation *is* the act of construction. Through this mechanism the different cases of the theorem are created.

A crucial pattern present here is the arrangement of the operations *addition*, *multiplication*, and *power* in the *alpha/omega* modular state. That is, the first operation, *arithmetic*, is placed in the top position, rotation places *multiplication* in the lower position, and then further rotation places *power* in the second state of the top position (think of how **0** and **12** share the top position in a kitchen clock). This unifies *addition* and *power* in the upper half of the overall state, with *multiplication* below and secondary:

The Positive Operations, Alpha/Omega Form



This makes *multiplication* distinct as the construction operator. This overall pattern becomes the basis for the Fermat relationship.

To construct Fermat's Last Theorem we begin by writing algebraically the archetypal statement of the operation of addition, with the integers as the domain for the variables:

$$\mathbf{X + Y = Z}$$

It is necessary to view this written statement more formally, where we recognize that it is actually *observed* to be *a series of numbers (first general, then specific) and operators in sequence*. Each **number** and **operator** is a **component** of the equation statement. This becomes illustrative of what is meant by the phrase "formal construction." We will formally display this recognition of the component nature of the equation through the use of a box/grid method, as follows:

X	**+**	**Y**	**=**	**Z**

Such an arrangement will be called a **statement array**, and will be used throughout the proof. We can see it as assembling components in the following order:

NUMBER TYPE 2 OPERATOR NUMBER TYPE 1 OPERATOR NUMBER

Every statement array is to be labeled as **valid** or **invalid**. With this dual option we once again have opposite states, and the following is automatically true:

+1 VALID

-1 INVALID

More will be said below about the application of this pattern.

Now note that addition is the first and original operation, and that every other algebraic/arithmetic operation is defined in terms of it. We therefore recognize the above algebraic statement as *the first equation type involving an algebraic and arithmetic operation*. For each such equation or statement type we will ask whether or not it is **valid**, in that numbers can actually be found to solve it (again, this is algebra *preceding* arithmetic). The original equation type, X + Y = Z, is categorized as **valid**. We easily cite 1+2 = 3 as proof.

We next view each variable as being a *power*. **We discover, however, that X and $\mathbf{X^1}$ *are distinct states in construction***. This must be true because as we construct the positive operations (beginning with addition, then proceeding to multiplication and powers), numbers are available (**X**, **Y**, and **Z**) that can unite first with addition, and then with

multiplication. These construction states precede the constructed existence of powers. Once *power* is available, we must write a new statement; $\mathbf{X = X^1}$, which makes **X** and $\mathbf{X^1}$ distinct states, equal only in numerical value. The same applies for **Y** and **Z**.

This results in a new statement array:

$\mathbf{X^1}$	+	$\mathbf{Y^1}$	=	$\mathbf{Z^1}$

We categorize this as *the second equation type involving algebraic and arithmetic operations (the introduction of powers)*, and label it as **valid** (look again at the lower diagram of page 28).

We now list the two states constructed so far, coupling them together in a new type of **coupled statement array** where two arrays are joined:

X	+	**Y**	=	**Z**
$\mathbf{X^1}$	+	$\mathbf{Y^1}$	=	$\mathbf{Z^1}$

This act will be valid only if both statements can be shown to be valid simultaneously. To test this we regard these statements as forming a simultaneous system of equations. Doing so shows them to be identical in numerical value calculations, and therefore to exist in identity. As a system, the equations each have an unlimited number of identical solutions (x, y, z), simultaneously. Here, the algebraic states can be immediately replaced with specific arithmetic values. Thus, two simultaneously valid equations are coupled together.

The operation of multiplication now becomes active. Multiplication requires two factors, and these are found to be the arrays, and the components of the statements themselves. In the statements, addition proceeds horizontally, but now multiplication will proceed vertically because addition and multiplication are orthogonal.

The relationship between addition and multiplication as orthogonal operators creates a new 5×5 box/grid form we will call **the statement construction array**. It provides the formal means for the construction of new algebraic statements, where addition proceeds horizontally and multiplication proceeds vertically:

This structure will cause two statement arrays to be multiplied vertically as a formal process of construction. To produce a valid result each of the input statement arrays must be valid simultaneously so that we have:

$$\textbf{(VALID)} \times \textbf{(VALID)} = \textbf{VALID}$$
$$\textbf{(+1)} \quad \times \quad \textbf{(+1)} \quad = \quad \textbf{+1}$$

We now insert the coupled and valid statement arrays constructed above into this construction form. The procedure immediately produces a new and valid equation type:

$\mathbf{X}$	+	$\mathbf{Y}$	=	$\mathbf{Z}$
×	×	×	×	×
$\mathbf{X^1}$	+	$\mathbf{Y^1}$	=	$\mathbf{Z^1}$
=	=	=	=	=
$\mathbf{X^2}$	+	$\mathbf{Y^2}$	=	$\mathbf{Z^2}$

The orthogonality relationships determine that we must formally multiply the positive operators that are present, replacing each with +1 so that (addition)(addition) = addition and (equality)(equality) = equality. We discover that the statement construction array has produced a new case of the second equation type (the addition of like powers producing a like power).

We formally observe that the constructed state $\mathbf{X^2 + Y^2 = Z^2}$ is a **valid** equation statement, citing (x, y, z) = (3, 4, 5) as proof.

We must view the individual statement arrays as follows:

$\mathbf{X}$	+	$\mathbf{Y}$	=	$\mathbf{Z}$
$\mathbf{X^1}$	+	$\mathbf{Y^1}$	=	$\mathbf{Z^1}$

Coupled; specific arithmetic values can be applied.

$\mathbf{X^2}$	+	$\mathbf{Y^2}$	=	$\mathbf{Z^2}$

Single; specific arithmetic values can be applied,
but these are distinct from those in the coupled system above
because the two array states themselves (coupled and single) are distinct

Note that this is not the same as vertically "multiplying" equations so that specific solutions (x, y, z) are the same for all three, in an attempt to "solve a system." We are *constructing* equation types and their specific manifestations, asking whether or not they are valid as equation statements that can stand on their own. Again, this multiplication procedure produced a valid equation result.

Now list *the equations containing powers* constructed so far, such that they are tentatively joined as coupled statement arrays:

$\mathbf{X^1}$	+	$\mathbf{Y^1}$	=	$\mathbf{Z^1}$
$\mathbf{X^2}$	+	$\mathbf{Y^2}$	=	$\mathbf{Z^2}$

This a temporary arrangement until we regard these statements as a simultaneous system of equations and examine the nature of the relationship. For them to remain coupled they must both be valid *simultaneously*. The result of this examination is that there are *no* nonzero solutions (x, y, z), a condition precisely opposite to the first simultaneous system above, which as an identity had an unlimited number of solutions. Discovering that these equation forms are disjoint means that the statements cannot be considered valid simultaneously, or coupled in this way, and that the true statement for a coupling of this type is either:

$\mathbf{X^1}$	+	$\mathbf{Y^1}$	=	$\mathbf{Z^1}$
$\mathbf{X^2}$	+	$\mathbf{Y^2}$	$\neq$	$\mathbf{Z^2}$

or

$\mathbf{X^2}$	+	$\mathbf{Y^2}$	=	$\mathbf{Z^2}$
$\mathbf{X^1}$	+	$\mathbf{Y^1}$	$\neq$	$\mathbf{Z^1}$

where the two statements in each pairing follow the if/then pattern (if the top statement, then the bottom statement). Now each coupled statement is **valid** for an unlimited number of simultaneous solutions, and the two statements are valid simultaneously. The top version is all that is required for what follows. Applying the same multiplication procedure gives:

$\mathbf{X^1}$	+	$\mathbf{Y^1}$	=	$\mathbf{Z^1}$
×	×	×	×	×
$\mathbf{X^2}$	+	$\mathbf{Y^2}$	$\neq$	$\mathbf{Z^2}$
=	=	=	=	=
$\mathbf{X^3}$	+	$\mathbf{Y^3}$	$\neq$	$\mathbf{Z^3}$

Here we calculate (equality)(nonequality) = (+1)(-1) = -1 and thus nonequality. We describe the theoretical relationship $X^3 + Y^3 = Z^3$ as being **invalid**, and write the $\neq$ statement, as constructed. Only when written as $\mathbf{X^3 + Y^3 \neq Z^3}$ is the statement considered to be **valid**.

For powers we now have three valid statement arrays:

X^1	+	Y^1	=	Z^1

X^2	+	Y^2	=	Z^2

X^3	+	Y^3	≠	Z^3

To proceed further requires one more realization relative to the geometries that exist inside the sphere. This will provide the proper residence for each of the states we are constructing. This in turn will allow us to work with the three statement arrays listed above.

Everything about this construction process can be seen in an actual model we can build. For this construction process we see that the sphere is real, with a small thickness. The Observer constructs "lines" as axes, but these are actually cylinders with very small diameter. For numbers, the cylinder is partitioned in a regular way and each section is the residence of a signed whole number. Notice that in this axis system the numbers are not about geometric *length*, but are instead numbers *in particular forms of sequence*, correct for Fermat's Last Theorem.

Inside the sphere there is another geometric object that can be automatically constructed, and this is the circular disk defined by any two of the axes (here the construction proceeds in the opposite order from the paper found in part one; there it was disks, cylinders (see page 8) and here it is cylinders, disks, as an extension of the bottom row of the opposite state operators array; see page 21, where we add disks to those cylinders).

Three axes can create three such disks, orthogonal to each other. We therefore have three disks for each set of three colored axes; three red, three green, and three blue. Each disk is a thin shell, and each can be partitioned into sectors. Each sector is a **state**, and can contain numbers, operators, or even whole statement array forms. Each of our constructed states must be able to exist within a particular disk, available for observation.

Note that any particular disk and its contents can be seen alone since the Observer can deconstruct the structures as needed until only the desired form remains. The fact that cylinders and disks intersect when all combined inside the sphere does not affect the status of the individual cylinder or disk and the pattern it otherwise displays, when viewed alone.

We begin by examining the nature of the three red disks. They naturally construct as follows. The first red disk contains, in three sectors, the three statement array forms:

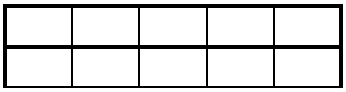
RED DISK #1

First Sector

The Statement Array

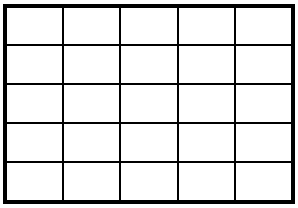
Second Sector

The Coupled Statement Array



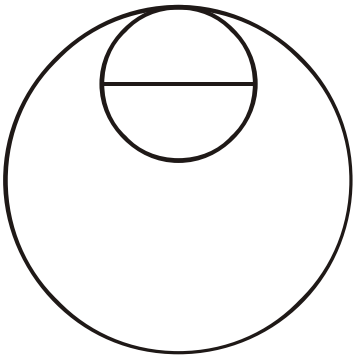
Third Sector

The Statement Construction Array



The second disk contains **the alpha/omega state**, which is the origin for placing numbers or other patterns in a **modular** form such that rotation begins and ends at the top position. This couples together the first, or alpha state and the last, or omega state, shown schematically as follows (actually, the top sector is partitioned into an upper half and a lower half, but this notation is more helpful):

RED DISK #2



The number of actual sectors in this disk is determined by the particular circumstance in construction. What does not change is the dual nature of the top sector position. *This alpha/omega form applies throughout mathematics, and within the laws of nature.*

The third red disk contains the archetypal statement of addition, which acts as the origin for the entire Fermat pattern. It exists in five sectors, with one component per sector:

RED DISK #3

First Sector	Second Sector	Third Sector	Fourth Sector	Fifth Sector
X	+	**Y**	=	**Z**

The nature of the green and blue disks will be described below. For now we will use red disk #2 to extend our construction of algebraic statements. Once we obtain the previously displayed list of valid statements,

X^1	+	Y^1	=	Z^1

X^2	+	Y^2	=	Z^2

X^3	+	Y^3	≠	Z^3

we place them in the modular structure of the alpha/omega form. This causes the first and last entries to be coupled in the top position, forming a new coupled statement array:

X^1	+	Y^1	=	Z^1
X^3	+	Y^3	≠	Z^3

We then multiply via the statement construction array:

X^1	+	Y^1	=	Z^1
×	×	×	×	×
X^3	+	Y^3	≠	Z^3
=	=	=	=	=
X^4	+	Y^4	≠	Z^4

Repeating the modular placement of the four states constructed so far will again cause the pairing of the first and last entries in the sequence, giving:

X^1	+	Y^1	=	Z^1
×	×	×	×	×
X^4	+	Y^4	≠	Z^4
=	=	=	=	=
X^5	+	Y^5	≠	Z^5

This pattern repeats indefinitely, and creates the full fact of Fermat's Last Theorem.

A note: It may be asked why we could not couple two nonequalities and "multiply" as follows:

$$X^3 + Y^3 \neq Z^3$$
$$X^4 + Y^4 \neq Z^4$$
$$\overline{\qquad\qquad\qquad}$$
$$X^7 + Y^7 = Z^7 \quad \textbf{"Valid" Equation Type}$$

The reason we cannot do this is because *it is not possible for two nonequalities to be coupled <u>in construction</u>*. This is true for the following reason. Suppose that we write:

$$3 + 5 \neq 9$$

Notice that this statement cannot stand alone. How do we *know* that 3 + 5 does not equal 9? The reason is because we (as the observer) added 3 and 5 and obtained 8. This creates a coupled state:

$$3 + 5 = 8$$
$$3 + 5 \neq 9$$

The order is: *since 3 + 5 = 8, 3 + 5 ≠ 9*. Every nonequality that may arise must be coupled with an equality statement. It is not possible for two nonequality statements to be coupled together *when we require that they be formally constructed.* Notice that this has occurred in each case above, as in, for example:

$$X^1 + Y^1 = Z^1$$
$$X^2 + Y^2 \neq Z^2$$

The final step is to display the contents of each of the three green and blue disks. These are as follows:

GREEN DISK #1

X	+	Y	=	Z
X^1	+	Y^1	=	Z^1

GREEN DISK #2

X	+	Y	=	Z
×	×	×	×	×
X^1	+	Y^1	=	Z^1
=	=	=	=	=
X^2	+	Y^2	=	Z^2

GREEN DISK #3

X^2	+	Y^2	=	Z^2

BLUE DISK #1

X^1	+	Y^1	=	Z^1
X^N	+	Y^N	≠	Z^N

N≥2

BLUE DISK #2

X^1	+	Y^1	=	Z^1
×	×	×	×	×
X^N	+	Y^N	≠	Z^N
=	=	=	=	=
X^{N+1}	+	Y^{N+1}	≠	Z^{N+1}

N≥2

BLUE DISK #3

X^{N+1}	+	Y^{N+1}	≠	Z^{N+1}

N≥2

In summary we see that the three groups of colored linear axes (red, green, and blue) provide the statement array components (numbers and two types of operators), the red disks provide the tools of construction, the green disks involve the construction of *equality* statements, and the blue disks provide the general statements regarding *nonequality*, and therefore of Fermat's Last Theorem, culminating as the statement array in blue disk #3.

Conclusion

While Fermat probably did not think of the proof in exactly the way it is presented here, it is entirely possible that this analysis of the sequential construction of the algebraic states of the form $X^N + Y^N = Z^N$ was what Fermat had noticed, and what he was referring to when he wrote his marginal note. The key insight regarding opposite and orthogonal states, and the sequential multiplication, could certainly have been observed by him.

Exercise: Reread Fermat's original statement shown on page 23. Note that he does not actually say what kind, or what kinds of numbers he is referring to. The theorem is stated in two different ways in various mathematical literatures (check books and the Internet, for example). The first form states it as applying only to the natural numbers. The second form states it as applying to the integers. Investigate whether this theorem is actually true for these three forms: the natural numbers, the nonzero integers, and the nonzero rational numbers.

Part Three

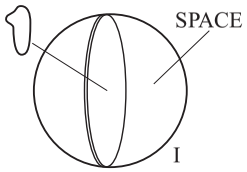
The Preprinted Flowchart

Derivation of the Masses for the Proton, Neutron, and Electron

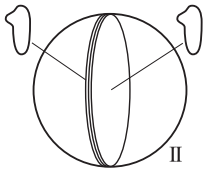
Derivation of the Masses for the Proton, Neutron, and Electron Flowchart

LINE 1

LINE 2



LINE 3



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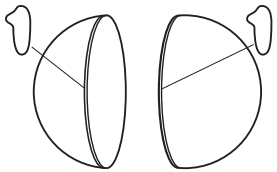
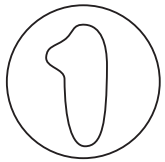


COLUMN A **COLUMN B**

LINE 5



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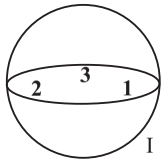

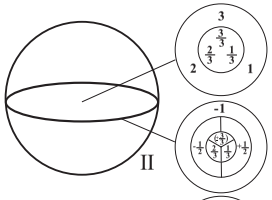

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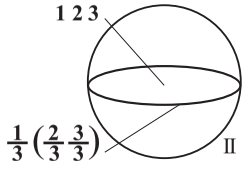
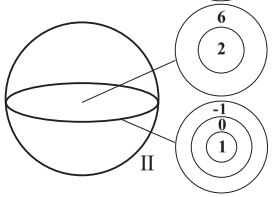
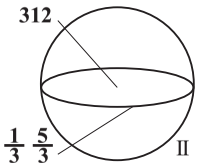


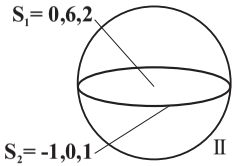


COLUMN A

COLUMN B

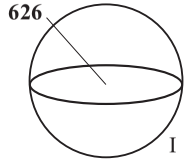
LINE 8

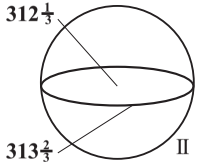


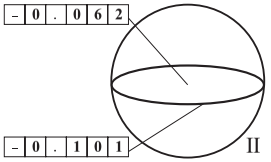


COLUMN A′

LINE 9



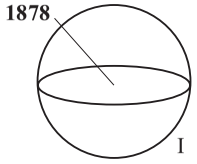


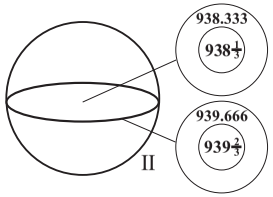


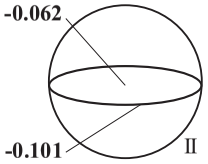
COLUMN B′

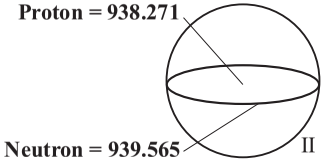
COLUMN B″

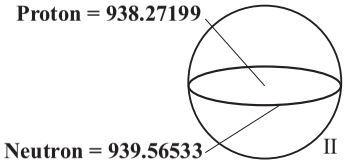
LINE 10



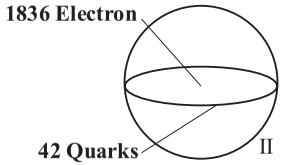






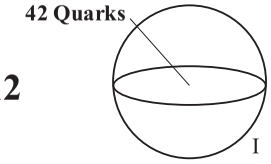


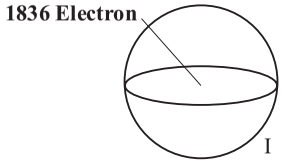
LINE 11



COLUMN A″

LINE 12





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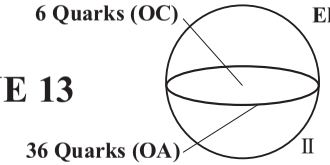
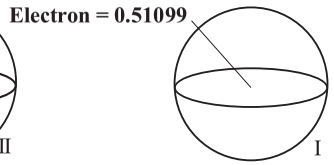




Derivation of the Masses for the Proton, Neutron, and Electron

MARK PROVO

ABSTRACT

The direct derivations of the masses for the proton, neutron, and electron are provided. A simple calculation derives these values to five decimal places, in exact agreement with experiment.

This paper introduces a new way to approach the direct derivation of the constants of nature. So far, no such derivations have been found, as indicated by Professor John Barrow of Cambridge University in his 1994 book *The Origin of the Universe*:

> [A]lthough these constant quantities appear in all our laws of nature, they are root the deepest mystery about the structure of the universe. *Why* do they have the particular values they do? It has always been the goal of physicists to come up with some complete theory of physics in which the values of the fundamental constants are either predicted or explained. Many great scientists have tried; all have failed to make any headway with this problem. (pp. 106-7)

Two new and combined mathematical methods will be introduced here. The first involves *counting*, and the second is a new mathematical structure that will be referred to here as *the dual hierarchy*. The application of these two techniques will produce a direct and united computational derivation for the masses of the proton, neutron, and electron, to five decimal places, in exact agreement with experiment. The fact that this method works reveals to us a new kind of logic in regard to how mathematical entities can originate, and how they can combine to produce a measurable result within the fundamental laws and constants of physics.

Hierarchical Structures in the Laws of Nature

It is discovered to be an oversight in our mathematical and scientific thinking to not have a well-developed mathematical understanding of *hierarchies*. The fact that hierarchies do exist in nature is an obvious fact. Living forms are always arranged hierarchically, from simpler to more complex forms. In physics, the atom exists as a hierarchical state involving two primary levels:

ELECTRONS

NUCLEUS

The first importance of such a structure mathematically is that it provides a form within which counting can occur. (We can see counting present in, for example, the progression of atomic numbers in the periodic table, and in E = Nhf.) We count in one of two main ways. We use *ordinal numbers* (best thought of as *sequence numbers*), such as:

1st, 2nd, 3rd, . . .

or *cardinal numbers* (best thought of as *summation numbers*):

1, 2, 3, . . .

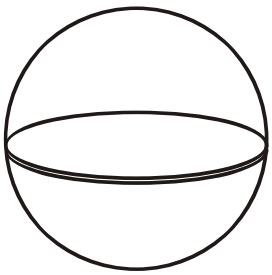
Both forms of counting are found to be present in formal constructions of the laws of physics. In the case of the atom examples to be presented here, cardinal numbers will predominate.

The first hierarchy state is:

$$\frac{\mathbf{A}}{\mathbf{B}}$$

We call this state **The Dual Hierarchy**. The primary geometric picture of this is the side view of a sphere with a circular disk located at the equator, creating an upper half state and a lower half state:

Sphere/Disk Origin for the Dual Hierarchy



The dual hierarchy state is present at the very foundations of arithmetic, as shown in the first paper, *The Modular Form as the Basis for the Primary Operators of Mathematics.* The most important feature of the dual hierarchy is that it can be a basis for counting. The first frame for cardinal number counting in the dual hierarchy is:

$$\frac{\mathbf{1\ \ A}}{\mathbf{2\ \ B}}$$

The first general application of this counting state is:

A

B C

The second general application of this counting state is an extended dual hierarchy:

A

B

C

Here, A is a single state while the lower level of the overall dual hierarchy is itself a dual hierarchy. It is this state that acts as the basis for the structure of the atom, as follows:

ELECTRONS

NUCLEONS

QUARKS

Deriving Structures of the Atom Using the Dual Hierarchy

To derive the overall structure of the atom we begin by identifying the *single state* form:

ATOM

We then regard the interior of the atom as a *dual hierarchy*:

ELECTRONS

NUCLEUS

Then apply cardinal counting as before:

1 ELECTRONS

2 NUCLEUS

We see that this manifests as the distinction between the two nucleons:

1 ELECTRON

2 NUCLEONS

This becomes the following, in which we see listed the three primary particles of the atom:

ELECTRON

PROTON NEUTRON

Next apply the other dual hierarchy form that causes the **2** appearing in

1 ELECTRONS

---

2 NUCLEUS

to manifest as another dual hierarchy. This results in the distinction between the nucleons and the quarks:

ELECTRONS

NUCLEONS

QUARKS

Now count these levels from top to bottom:

1 ELECTRONS

---

2 NUCLEONS

---

3 QUARKS

The numbers correspond exactly with the states we observe. The application of the above state is that there is one type of particle in the electron level, the electron. There are then two types of nucleons, the proton and neutron. Further, the quarks are associated here with the number three, and this becomes the fact that there are three quarks within each nucleon. The numbers correspond because this is how the physics was constructed in the first place.

Now count only the two levels of the overall lower level:

ELECTRONS

---

1 NUCLEON

---

2 QUARKS

This pathway results in the fact that each single nucleon (**1**) contains quarks of two flavors (**2**), *the up quark* and *the down quark*:

ELECTRONS

NUCLEON

UP QUARK DOWN QUARK

Now progressively count the extended dual hierarchy, in the following way:

1 ELECTRONS

---

1 2 NUCLEONS

---

1 2 3 QUARKS

Read this flowing downward as three forms; first (**1 2 3**), then (**1 2**), then (**1**). Now read the rows to the right as the application in the atom. The top row shows that the electron stands alone as a single category, **1**. For the nucleons we need **1 2** because each particle is seen as either belonging to one category (**1** = *nucleon*), or as belonging to one of two categories (**2** = *proton* or *neutron*). Each has distinct applications.

The most important pattern here is the sequence that appears on the bottom row, **1 2 3**. It is the final resultant from the *ordered construction* of the array which proceeded downward. The sequence **1 2 3** is associated with the quarks. It is then followed by an *ordered application* that proceeds *upward* from the bottom row of the hierarchy. This creates the mass derivation, based on **1 2 3**. New numbers associated with the quarks will first be calculated; these will in turn lead to the calculation of the masses of the proton and neutron (through linear combination and the addition of a further decimal state), and this will then be followed by a third step which derives the mass of the electron. To do the mass derivation we will have the sequence **1 2 3** to work with, constructed by and from the hierarchical array above.

So far we have found a set of numbers, **1 2 3**, to act as a basis. The remaining question then becomes, "What is the *geometric* basis for these numbers? Where do they reside?"

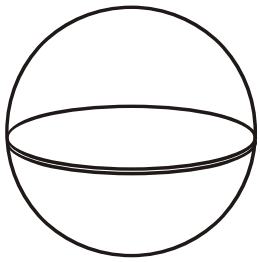
Our requirement here will be that this geometric basis be *observable* by us as observers. This means we can build an actual model. We can therefore visibly see every mathematical state that exists within the resulting system. One consequence of this requirement is that nothing in the system will involve more than three geometric (right angle, orthogonal) dimensions, **X**, **Y**, and **Z**.

To understand what this basis is we need to discuss topics involving the sphere and the disk, and how the three disks/cylinders state is created. We will discover that the geometric residence we seek is a sphere with three disks and three cylinders at right angles inside. This state will be called the Modular Form.

The Modular Form

Note that the geometric picture of the dual hierarchy begins with the sphere containing a circular disk at the equator:

Sphere with Disk



This sphere/disk form becomes central to mathematics and physics when that state is extended, often through formal counting procedures like the ones explained here. Particles, for example, do have properties constructed from the sphere/disk state. This will be shown to be true here in regard to the masses of the primary atomic particles. The masses of the proton, neutron, and electron will be found to reside in the three orthogonal disks of a Modular Form. Each step of mathematical construction will be a change of state from one single disk state to another single disk state.

The usual way of thinking of a "disk" in mathematics is that it does not actually have "faces." And yet anyone can create a circular disk that *does* have faces out of a piece of paper or cardstock. This is a real mathematical object; in fact, it is the best kind because we can directly observe such a state and its constructed internal features (sectors and their contents, concentric regions and their contents, and so on). There is nothing abstract about it. What becomes especially important is that we can build an actual model of the sphere with disk. If we allow the sphere and disk to have an actual small thickness, a new mathematics is possible. It becomes the mathematics of observation. As we will see, that mathematics is being used in the creation of the laws of nature.

Any single disk is actually a shell boundary with an interior region. View the disk from above and the interior can be partitioned into sectors, where each sector can become the residence of a mathematical state (a number, a variable, a combined mathematical state, and so on). Think of a kitchen clock appearing in this form, with sector lines.

The disk at the equator of the sphere creates two observer frames. The first observation is through the North pole and is of the top disk face. The second observation is through the South pole and is of the bottom disk face.

Each such single disk is said to be *clear*, and is described as being a "one disk" (denoted by the notation "I disk.") This means that the observation from each pole position is the same. Only the North pole observation is required for the observer to attain complete knowledge of the state of the disk. (Picture a kitchen clock that instead contains all **1**'s, with sector lines, embedded in clear glass within a clear disk boundary.) The I disk is a single state.

But it is also possible to have two disks joined as a unit, one on top of the other. We call this dual disk state a "twin disk" and denote it by "II disk." Now both observations are required to know what is on the top and bottom faces of the overall unit state (each face is itself a I disk). Since the observer cannot read both sides from one observation, the overall state is described as being *opaque*. The II disk is a dual hierarchy.

Physics calculations reside in these circular disk forms. Note again that we can have up to three such disks within the sphere, each at a right angle to the others. This triple disk state, the Modular Form, is the key.

The Modular Form Creates the Families of Fundamental Particles

One immediate application of this state that can be recognized is the fact that there are exactly three families of fundamental particles, each with four matter and four antimatter forms. This is discovered here to be an application of the II disk where all three disks are present in the sphere. Note that when all three disks are present, each disk is partitioned into four quadrants by its intersections with the other two, orthogonal, disks. The front face of any disk contains entries from the category *matter*, while the back face, facing in the *opposite* direction, contains entries from the category *antimatter*. (There is a *category arithmetic*, and this is one example from it).

The first particle family, seen on the front face of Disk A, is:

Electron Electron Neutrino

Up Quark Down Quark

The *category names* appear in the disk form in this way as the first step in the scientific application of the sphere with three orthogonal disks that constructs these particles.

The antimatter forms of these particles appear on the back face of the same quadrant. This II disk is the normal, single unit state, with the antimatter side usually inactive. But at high energies these antimatter states can appear, as can heavier versions of these four-

particle families. This creates two more possible family states, to be found on the other two orthogonal disks, also usually inactive:

Muon Muon Neutrino

Charm Quark Strange Quark

Tauon Tauon Neutrino

Top Quark Bottom Quark

It has long been a mystery why there are exactly three such particle families. The reason is shown here to be the fact that no more orthogonal disks are possible.

Again, we will refer to the three disk state within the sphere as being a particular application of the Modular Form. (The Modular Form is not to be confused with the "modular forms" of number theory). The Modular Form is like the "central processing unit" for the laws of physics. It is where the laws reside.

Two further notes can be added. First, this creates a location for *modular* (circular) number patterns, and a new form of number called Modular Numbers [the precursor to a modular arithmetic as described in mathematics, previously undiscovered]. And second, we see that the intersection of three I disks with width creates three square tubes within which we can construct three intersecting cylinders. These cylinders become the axes for number patterns, and the residence for such physics phenomena as velocity, acceleration, force, momentum, kinetic energy, and so on.

When we want to do a mathematical calculation, we use the Modular Form as calculator (see page 10). This will appear here in the calculation of the particle masses. Before describing this, however, we must see how the Modular Form is first derived. It has a special cause.

What is Energy?

During a recent television documentary on the physics of energy, four different physicists were asked the question, "What is Energy?" Each gave a completely different answer. This indicates that a clear understanding of what Energy is *existentially* has not yet been attained. New answers to the question, "What is Energy?" will be introduced here.

To begin, view the phenomenal universe as being: The backdrop of space (*empty*) in combination with all forms of energy that appear [particles, atoms, and waves; *full* (instead of empty space), with *full* being the state opposite to *empty*].

This means that *phenomena* are <u>all</u> states of *fullness*. We then wonder what this means.

To *fill* something requires a boundary be present, defining a region that must be filled. Once filled, it is said to be *full* as opposed to being *empty*.

The tangible picture of this is to compare the empty sphere with a sphere that is filled with a substantive medium (something is actually there, a substance; think of a sphere filled with delicate white pudding).

The universe begins as a bounded substantive medium, where the medium is the state we call **Energy**. The boundary is a sphere with small thickness. We see it like this:

Sphere Boundary

Ball Medium

This is renamed as follows:

Sphere Boundary

Energy Medium

We then draw the following very important diagram:

Sphere with Energy Medium

As helpful methods for drawing the sphere or ball by hand, notice the cross-hatch notation that indicates the presence of a sphere, and the glimmer in the lower left corner that indicates the ball (think of how light creates such a glimmer when shining on, say, a cannonball). Whole Number One is shown as a large open faced One, as above. (Take a moment to review the top half of page 7.)

The Energy Medium, written **1Energy** (read, "Whole Number One Energy"), has ten features:

1Energy Is . . .

1. **Whole Number One**
2. **A Substantive Essence Medium**
3. **Observer**
4. **Origin of Thought**
5. **All, and All Observer Mathematics**
6. **Intelligent Creativity**
7. **Nonlocal/Local**
8. **The Laws**
9. **Phenomena = Full (Compared to Space)**
10. **Unfolding of the Whole Universe**

The mathematics of Energy is Observer Mathematics. We see the state contained by the sphere, Energy, as being a thinking, intelligent, creative Observer, determiner of the laws, and always active. The most important feature of Energy is that, mathematically, it is *Whole Number One*. This is the *All* state. Phenomena are secondary appearances of energy (now with a lower case "e"), as the states we call *full* when compared to the adjacent *emptiness* of space. All of these phenomena are then related locally and nonlocally, and that relating occurs in the mind of the Observer, the ordering Intelligence.

More occurs when we center the Energy medium. The original medium state is not automatically centered. We must actually construct, as a secondary state, a small centering sphere. This creates a new interior state that will be opposite to Energy, and this becomes **Space**. This creates the following dual hierarchy:

1 ENERGY ALL

---

0 SPACE EMPTY

The original state of Energy for the universe exists *above* voluminal space. The voluminal space and phenomenal universe we observe are actually inside the centering sphere of the far larger Energy medium. That senior state of Energy is **1**. Space, **0**, then resides "below" Energy, within the centering sphere, as shown in the above dual hierarchy.

Now view the above dual hierarchy as the first state constructed. From this construct an application by reversing the order of the levels, where Energy is now "full:"

0 SPACE EMPTY

---

1 ENERGY FULL

This becomes the particle state. As it is first constructed, the particle archetype is a sphere boundary surrounded by voluminal space, containing a **1** energy medium inside. Mass resides on the surface of the sphere (rest mass on the inner surface and relativistic mass on the outer surface). The sphere with axis of rotation (a cylinder) creates the source for *magnetism*. The particle's interior energy medium changes state from **1** to become either **-1**, **+1**, **0**, **-1/3**, **+2/3**, etc., as the location of *electric charge*. The nucleus and electron orbitals contain whole number one as their energy medium state.

An added note: Any field, such as the electric field or the gravitational field, is ordered change of state within a specific energy medium that is a subset of the single Whole Number One Energy Medium.

Now recall this extended dual hierarchy form:

A

B

C

This manifests as:

ENERGY MEDIUM

SPACE

PHENOMENA

To which we can add the key descriptive features:

ENERGY ALL

SPACE EMPTY

PHENOMENA FULL

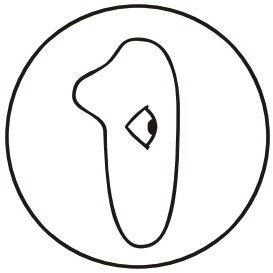
We see that the states *empty* and *full* are coupled as a dual, opposite states relationship.

Each phenomenal particle or atom is a discrete form of energy that locally centers Energy (*not* space, per se, except secondarily). This local centering creates a changeable coordinate frame in Energy for the motion of the particle.

The General Construction of the Modular Form

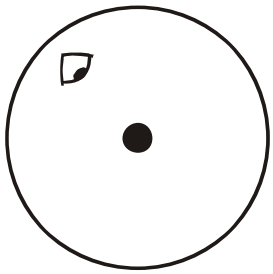
To create mathematics the Observer form of Energy generalizes its own state, in thought, creating a white, precentered, Whole Number One Energy Medium within a sphere:

Sphere with Intelligent Observer Energy



The next step is to center the medium, creating a smaller sphere with a black medium inside (a modification of Energy as the state *opposite* to the white Energy medium; now *empty space*):

Observer Energy Viewing
Centering Sphere with Interior Space



Now the Observer constructs three orthogonal disks and three orthogonal cylinders centered by the center of the space. We then have a sphere (full) containing empty space except where the disks and cylinders are (full). Recall that all *phenomena* are the state *full*. This leads to the following pattern:

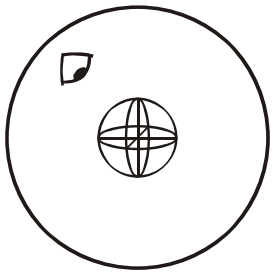
PHENOMENA = FULL = SPHERE/DISKS/CYLINDERS

This shows that the mathematics of phenomena (all of the laws of nature) will be resident in the sphere, disks, and cylinders.

This overall state, with three disks and three axes, is the Modular Form.

Now, when the Observer looks, what is seen is this Modular Form state.

Observer Energy Viewing The Modular Form



For the Observer the Modular Form becomes the observed. This is a noun state. The Observer then defines action, the verb, to be *Calculation on the Modular Form*.

Calculation and the Modular Form

Establish a Modular Form with three disks (I or II disk forms are possible). We label the disks as Disk A, Disk B, and Disk C. We then define calculation to be as follows:

Calculation on the Modular Form

DISK A: Input State
DISK B: Operator(s) to be Applied
DISK C: Output State

Any successive calculation takes the output from Disk C and uses it as the input for Disk A in the next cycle.

All of the operations of arithmetic can be seen as functioning in this way. For example, the addition of 3 and 5 can be seen as:

DISK A: 3
DISK B: "Add 5"
DISK C: 8

No matter what the operation, this form can be used to formally perform the calculation.

The Original Basis for the Derivation

We saw earlier that the number sequence **1 2 3** was constructed for the bottom row when we counted the triple hierarchy state of the atom:

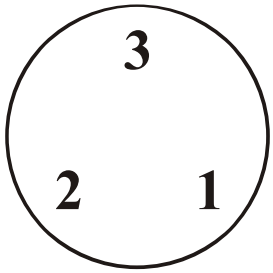
1 ELECTRONS

1 2 NUCLEONS

1 2 3 QUARKS

We now see that these numbers in the bottom row, **1 2 3**, can reside as a modular state in three sectors on a clear I disk (we will not draw the sector lines for simplicity):

The Sequence* 1 2 3 *Made Modular



With this pattern as the only basis, we will proceed to calculating the masses of the three primary atomic particles, obtaining these results:

Masses of the Primary Atomic Particles

Mass of the Proton: 938.27199 MeV
Mass of the Neutron: 939.56533 MeV
Mass of the Electron: 0.51099 MeV

To perform the calculation a further background pattern must be developed.

Whole Numbers and Integers

We see that the originating geometric state for all construction is a sphere with an energy medium inside. This primary energy medium state is **Whole Number One**, **1**. The overall state is *sphere senior to ball*, a dual hierarchy; the ball is the energy medium.

An overlooked distinction in mathematics and science is the fundamental difference between *whole number one*, **1**, and *positive one*, +**1**. These numbers must be seen as being distinct, equal only in the category of *numerical value*. Notice that simple counting,

1, **2**, **3**, . . . , does not require that the numbers be based in the number line, and note further that the sign distinctions of the integers have no meaning in counting. The whole numbers must come first as the fundamental number state required in the mind of the Observer for the purposes of counting and addition (creating successive numbers).

Integers, which are dualistic numbers based in opposite state geometries (disk or cylinder), must come second. It is from the integer basis that the full set of six operations of arithmetic originate (addition, subtraction, multiplication, division, power, and root, as applied to the integers). Our own human experience of number embodies this progression exactly. Everyone first learns to count, and to add, in thought, having never seen a "number line." As school progresses more is learned, but one does not usually learn about signed numbers and their arithmetic until seventh grade, at age 13.

Arithmetic is actually constructed as follows:

The Origin of Number and Arithmetic

Observer	**Whole Numbers in Thought**	**Counting, Addition**
Observed	**Integers in Disks or Axes of the Modular Form**	**Six Operations of Arithmetic (Three sets of opposite states)**

The structure of six defined arithmetic operations constructed in the lower level is then taken on by the whole numbers also:

The Basis of Number and Arithmetic

Observer	**Whole Numbers**	**Counting and All Arithmetic**
Observed	**Integers**	**Six Operations of Arithmetic**

Extension to the rational numbers for both levels occurs when the dual hierarchy is introduced. There are either whole numbers and whole number fractions, or integers with signed fractions. There are no irrational numbers, with "infinite" decimal sequences, in the laws of nature. Any "irrational" states would have bounds on their decimal sequences and would be made rational. Repeating rational decimals are also bounded.

To construct the laws of physics the Observer will use whole numbers for some things and integers for others. Note that each aspect of physics can be classified as being either *a constant state* or *a variable state*. The result is this:

Observer	Whole Numbers	Constants of Nature
Observed	Integers	Variables of Nature

Notice that in the top level of the hierarchy, the category *constants of nature* is the one area of physics where no progress in understanding has ever been made. This is because the crucial distinction between whole numbers and integers had not been realized, and because the Modular Form was unknown.

The first category of physics requiring construction is the constants of nature. This requires that the Observer has already determined a list containing all of the required categories (there is *space*, there are *atomic particles*, there are *constants of nature*, and so on). The constants of nature will be created from whole numbers, fractions, and decimals.

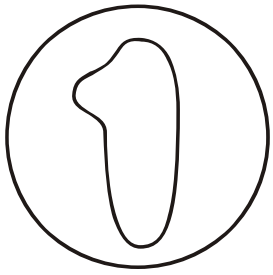
At the beginning we have the Observer, the Modular Form, and the Modular Form as Calculator, seen as a counted dual hierarchy:

1 Observer	
2 Modular Form (Noun)	Modular Form as Calculator (Verb)

We now begin to construct the array that creates *all* of the constants of nature (only showing those parts relating to the atomic particles and Planck's constant here). The Observer performs an ordered construction that unfolds as a flowchart in three dimensions, where spheres occupy cells in a lattice. The mass derivation here proceeds on a two-dimensional cross-section from within the larger overall array.

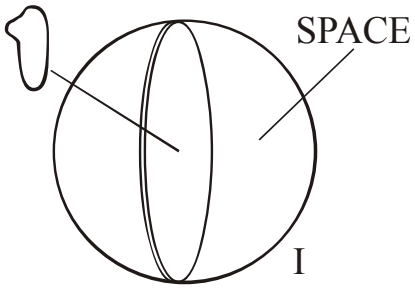
The beginning state is the sphere with whole number one medium inside. This creates the state for Line 1 (follow the diagrams on the preprinted flowchart):

Diagram for Line 1 of the Flowchart



Line 2 is a change of state in which the I disk appears for the first time. This disk is vertical. The entire whole number one ball medium state now becomes the interior medium of the disk. The interior of the disk is the new appearance of the energy medium whole number one. There is now empty space inside the sphere except where the disk is, at Line 2:

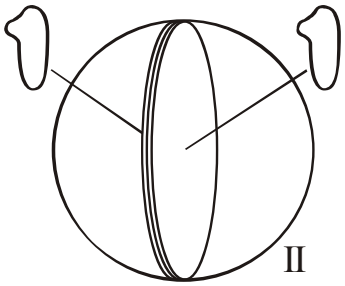
Diagram for Line 2 of the Flowchart



The change of state that then creates Line 3 results from changing the I disk to a II disk. When this happens, whole number one is duplicated as the interior medium of each disk (think of how a single water drop can divide into two single water drops; although this pattern is not based on the measurement of geometric volume as would be literally true for the water).

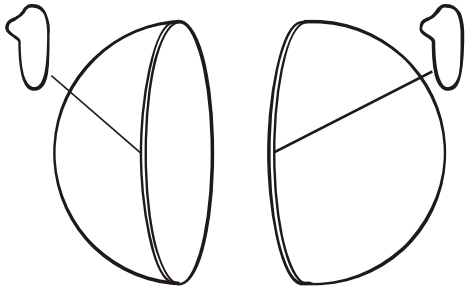
We now draw the diagram for Line 3:

Diagram for Line 3 of the Flowchart



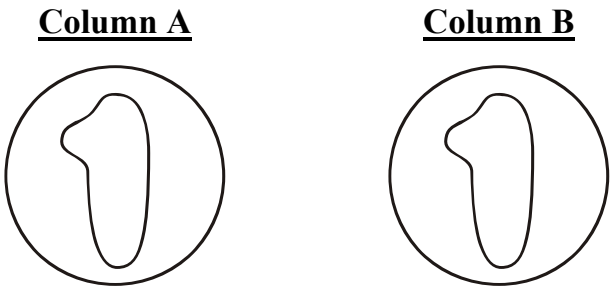
The fact that we now have a II disk allows us to separate the sphere into two hemispheres, each with a I disk acting as a boundary that closes the object. This is performed in Line 4:

Diagram for Line 4 of the Flowchart



We now reverse the process that changed state from Line 1 (whole number one filling the whole sphere) to Line 2 (whole number one now only inside the disk). Each hemisphere is a closed surface boundary state, and can be topologically transformed into a sphere. The disk tops facing the interior vanish and whole number one is restored as the full energy medium in each. This creates Line 5:

Diagram for Line 5 of the Flowchart

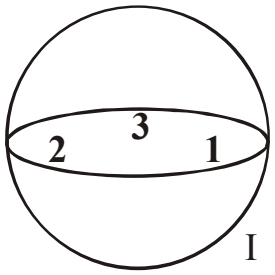


We now have the origin for two columns that will produce the calculation. Column A will be about whole numbers and fractions (converted to decimals), and Column B will be about decimals. When added in the last step, the masses of the proton and neutron will be one step from completion, and will already be correct to three decimal places.

From here on we must distinguish between entries in Column A and entries in Column B. This will be written as, for example, "Line 5, Column A" (apply this example specifically to the above diagram).

Each of the two spheres of Line 5 will next have a disk that is in the XY-orientation (at the equator). The unity value whole number one from Line 5 changes state to become the interior medium of these disks, as discrete number forms. The first sphere has a I disk, and contains our sequence of numbers, **1 2 3**, creating the originating entry at Line 6, Column A:

Diagram for Line 6, Column A of the Flowchart



The Calculation of Column A

The overall architecture of the flowchart from this point on must now be described. There will be two columns beginning at Line 5. Because this pattern is based on **1 2 3**, there will be a "triple origin" for the columns. This manifests as two sequential entries in Column A (Line 6 and Line 7) which combine to create one in Column B (Line 6). After this triple origin is constructed, the ordered calculation returns to Column A and proceeds downward. (Follow the preprinted flowchart as you read.)

The change of state applied to Line 6, Column A is to extend the I disk to be a II disk. This will not become the entry at Line 6, Column B. Instead, it extends downward to become Line 7, Column A. This is the first step in creating the triangular origin.

After changing to the II disk in this step, the state shown above (**1 2 3**) becomes the top disk face, and a new state will be constructed for the bottom face. To do this we regard the pattern as one of rotation, and see the state **1 2 3** as indicating that, here, three increments are involved. But a single rotation must also be about the number **1**, and thus the second form of rotation in three increments is:

1/3 2/3 3/3

We now summarize the II disk state by writing:

II Disk for Line 7, Column A

Top Face: 1 2 3
Bottom Face: 1/3 2/3 3/3

A further feature must be noted before this is seen as being completed and ready to draw as the next diagram. Notice that the sequence **1 2 3** is unique in that these are successive numbers which have the secondary feature that **1+2 = 3**. This can be seen as a partition operation in which three objects are placed into a group of one and a group of two (note immediately that the quarks will combine in just this way in relationship to the nucleons). Because this is a *secondary* feature, it will affect the values in the bottom face. The value

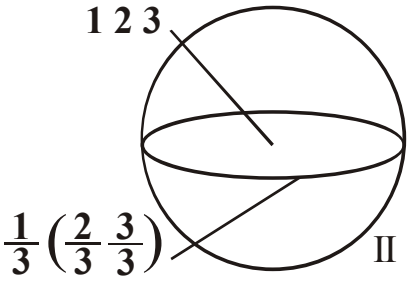
1/3 will stand alone and the values **2/3** and **3/3** will be grouped together. Rewrite the above statement like this:

II Disk for Line 7, Column A

Top Face: 1 2 3
Bottom Face: 1/3 (2/3 3/3)

We can now draw the diagram for Line 7, Column A:

Diagram for Line 7, Column A of the Flowchart



This change of state is summarized as the first Modular Form calculation (the calculations are performed to the side, in thought, or in a generic geometric model):

The First Modular Form Calculation

Disk A Inputs: I Disk, Top Face: 1 2 3
Disk B Operators: Top Face Operator: Identity
Bottom Face Operator: Construction as described above
Disk C Outputs: II Disk, Top Face: 1 2 3, Bottom Face: 1/3 (2/3 3/3)

Here, "calculation" is actually modification through further construction.

We now use the output at Disk C as the input for the second Modular Form calculation. This becomes the second step in creating the triangular origin. This second step is combined in a dual state with the operation proceeding from Line 6, Column A to Line 6, Column B, which is the third step in creating the triangular origin. The order of the steps is as follows (follow on the preprinted flowchart):

The Three Calculations that Create
the Triangular Origin, Ordered Construction

The First Modular Form Calculation

Line 6, Column A to Line 7, Column A (I Disk Changes to II Disk)

The Second Modular Form Calculation

Line 7, Column A to Line 6, Column B (II Disk Changes to I Disk)

The Third Modular Form Calculation

Line 6, Column A to Line 6, Column B (I Disk Changes to II Disk)

The first Modular Form calculation, proceeding from Line 6, Column A to Line 7, Column A, has already been explained. The second Modular Form calculation changes state from Line 7, Column A to Line 6, Column B, changing the II disk to a I disk. It takes the contents of the two disk faces and installs them in two concentric regions on the I disk:

The Second Modular Form Calculation

Disk A Inputs: II Disk, Top Face: 1 2 3, Bottom Face: 1/3 (2/3 3/3)
Disk B Operator: Install top face contents in outer circular region and bottom face contents in inner circular region, I Disk
Disk C Output: I Disk, Outer Ring: 1 2 3, Inner Ring: 1/3 2/3 3/3

The distinction is that there are now no parentheses. The third Modular Form calculation occurs immediately after the second because the two are linked for constructing the triangular origin. It changes the I disk of Line 6, Column A to a II disk at Line 6, Column B. An identity operation occurs as the contents of Line 6, Column A are seen to repeat in the outer ring already constructed above. The bottom disk face is blank, and must be filled in. Before explaining how the bottom face is to be filled in, summarize the third calculation:

The Third Modular Form Calculation

Disk A Inputs: I Disk, Top Face: 1 2 3
Disk B Operators: Top Face Operator: Identity to outer ring of Calculation 2
Bottom Face Operator: Construction as described below
Disk C Outputs: II Disk, Top Face: Outer Ring: 1 2 3, Inner Ring: 1/3 2/3 3/3
Bottom Face: See below

Drawing the diagram for the bottom face state requires some explanation. It begins blank, and we must discover what content will be present.

Note that for the step of the first Modular Form calculation, in Column A, only *number* was involved. We could write the following for the II disk of the second entry in that column (Line 7, Column A):

Top Face: Number
Bottom Face: Number

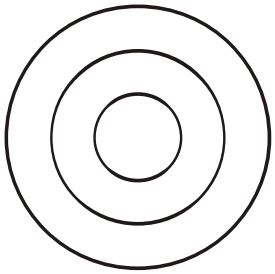
For Column B we will see the presence of the distinction between *number* and *geometry*, in the first entry at Line 6, Column B:

Top Face: Number
Bottom Face: Geometry

We have a blank disk face on the bottom that will involve geometry. Here is how we reason out what it must be.

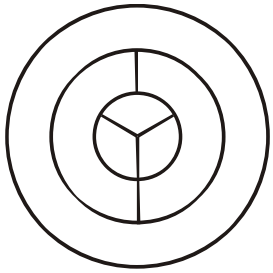
The top face shows the pattern of three increments going *around* the disk face. The other option is for the pattern of three increments to proceed *downward* in the disk face. This occurs by creating three concentric circular regions. We need to draw this as a diagram:

Diagram for Line 6, Column B, Bottom Face, Step 1



We then proceed downward and add partitions that cause the three rings to display the geometric pattern of **1 2 3**. The first, outer, ring has no added partitions. The second ring has partition lines added at the 12 o'clock and 6 o'clock positions (the vertical lines are only within the second ring area). There is now a left half and a right half to the second ring. The third region is partitioned into three increments with three sector lines, so that the lines are in the form of a letter Y (there must be a single top sector). This is an all geometric structure, with no numbers added to the regions:

Diagram for Line 6, Column B, Bottom Face, Step 2



Now examine geometric rotation in regard to these new ring states. The outer ring is whole and can only be about one full rotation. The second ring is dual, and notice that instead of making a full rotation from two increments, rotation could instead proceed from the top to the bottom in two opposite ways (a 1/2 rotation counterclockwise or a 1/2 rotation clockwise). The third ring can be seen as one full rotation, but proceeding in three increments. The following overall state is overlaid onto the diagram:

FIRST RING: Whole Rotation, Clockwise

SECOND RING: Dual Rotation, Counterclockwise/Clockwise

THIRD RING: Whole Rotation in Increments, Clockwise

These become the three distinct rotation forms that are possible for such an arrangement, such that the counterclockwise rotation state appears at least once. (It also fulfills an underlying modular pattern present, the "alpha/omega form," described generally below, beginning on page 79.)

Now the number category will step down from the top face, creating this:

Top Face: Number
Bottom Face: Geometry/Number

Such a step-down function is formally defined in this overall system of hierarchical patterns, and will be seen again.

We must now discover what numbers should go into the six regions found in the bottom face diagram.

The first step is to place the obvious values that correspond with the diagram. The outer ring is whole and should therefore receive the value **1** (so far). The second ring is divided into two sections that are opposite, partial rotations, and each should receive the value **1/2** (so far). The third ring is divided into three sections and should receive the values **1/3**,

2/3, and **3/3** respectively, so that **3/3** is in the top sector (so far). All of these values correspond with the forms of rotation that are present in the overall pattern.

Now signs enter into the pattern. Signs are basic to the atom. We see the electron with a charge of -1, the proton with a charge of +1, and the neutron with a charge of 0. (0 is a form of sign meaning "no sign," necessary for the origin or additive cancellation of the - and + signs.) We further see that, for the atom, the negative sign appears senior to the others because the electron is in the senior level of the overall dual hierarchy Electrons/Nucleus. Another observation to make is the ordered relationship of **-1** to **+1** on the number line: **-1** is first in order.

Now examine signs as a counted triple hierarchy, with the negative sign senior. Each counting value determines how many elements are found at that level of the hierarchy:

The Triple Pattern of Signs

1 -
2 - +
3 ± 0

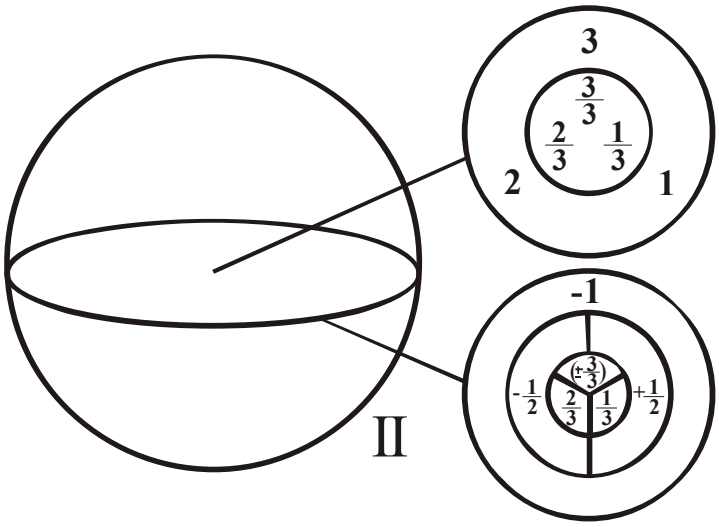
This structure is now installed in the regions of the bottom face, with these signs assigned to the numbers already there. The numbers become:

-1
-1/2 +1/2
1/3 2/3 ±3/3 with **0**

The diagram is on the next page. The innermost region (line 3 in the diagram above) is a modular form and has **0** at the top position (think of a kitchen clock where **12** and **0** reside in the same position).

The structure shown above is the completed form for the bottom face. This final state no longer relates to rotation or any other specific visual application; they are simply numbers. This is because we are doing the mass derivation, which is only about numbers. This step is one that depends upon the choices and logic of the Observer. The Observer uses this method to create the needed numbers. We can now draw the diagram for Line 6, Column B:

Diagram for Line 6, Column B of the Flowchart, Step 3



This completes the ordered construction of the triple origin for the two columns. We now use this as the basis for *ordered application*, the calculation of the mass values. This begins with change of state proceeding down Column A. The fourth Modular Form calculation proceeds from Line 7, Column A to Line 8, Column A.

The top face at Line 7, Column A contains the values **1 2 3**, installed in that order. We refer to this original creation as **ordered construction**. We then modify this state to create **ordered application**. How this is done will now be explained.

Think of a kitchen clock, and put all attention on only two values; the **12** and the **1**. We observe that sequence can naturally start from either position. When sequence starts at **12** ("the top position") we proceed around the clock in the normal fashion of telling time. When sequence starts at **1** ("the number one position"), a distinct sequence is formed.

We then generalize this to apply to all such modular states. We can primarily start sequence at **the top position** or at **the number one position** (no matter what specific values may be there).

The top disk face of Line 7, Column A (page 61) is the sequence **1 2 3**, starting at the number one position. This is ordered construction. Ordered application will therefore start at the top position and also proceed clockwise. The new sequence thereby created is:

3 1 2

Now notice that we will ultimately be developing masses for the particles in Base-10. One of the undiscovered facts about the laws of nature is that they operate in Base-10. This fact can be derived, but discussion of this will be omitted here. We see that this

presumption does work for the derivation, which itself provides major proof for this overall fact.

Base-10 is a template awaiting coefficients. The sequence just derived, **3 1 2**, provides these coefficients. Therefore, the operator for the top face is the Base-10 template awaiting coefficients, which are provided by the ordered application form of sequence emerging from the top disk face. The output for this operation is the Base-10 value:

312

For the bottom disk face we see the need to combine the grouped values of **2/3** and **3/3**, through addition. The result is **5/3**. This means that the new output form of the bottom disk face will be:

1/3 5/3

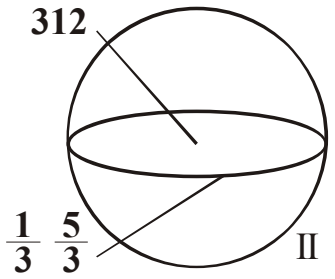
All of this is summarized as follows:

The Fourth Modular Form Calculation

Disk A Inputs: Top Face: 1 2 3, Bottom Face: 1/3 (2/3 3/3)
Disk B Operators: Top Face Operator: Base-10
Bottom Face Operator: Addition
Disk C Outputs: Top Face: 312, Bottom Face: 1/3, 5/3

The result is the modification of the original state/diagram into how it now appears as Disk C in the calculation. The next diagram is now ready:

Diagram for Line 8, Column A of the Flowchart



This is the output from the fourth calculation. We will now use it as the input for the next calculation:

The Fifth Modular Form Calculation

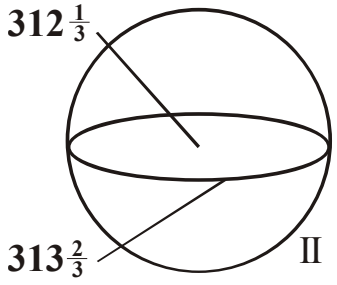
Disk A Inputs: Top Face: 312, Bottom Face: 1/3, 5/3
Disk B Operator: Add top face value to each bottom face value
Disk C Outputs: Top Face: $312_{1/3}$, Bottom Face: $313_{2/3}$

Here we add the top face value to each of the two bottom face values:

$$312 + 1/3 = 312_{1/3}$$
$$312 + 5/3 = 313_{2/3}$$

This new output form becomes Line 9 for this column:

Diagram for Line 9, Column A of the Flowchart



Now recall that the original number sequence **1 2 3** was associated with the quark level. We have just derived two values, and these will become associated with the up and down quarks. These numbers are basis values for the calculation of the proton and neutron masses (these are not the quark masses themselves, however, which are calculated through a different pattern). We summarize this as follows:

Basis Values for Quarks in Nucleon Mass Calculations

Up Quark Basis Value: $312_{1/3}$
Down Quark Basis Value: $313_{2/3}$

We know that the proton contains three quarks, in the form of two up quarks and one down quark, while the neutron contains one up quark and two down quarks. This is a basic linear combination (and we know that the nucleon charges can be calculated from linear combinations of the quark charges). This becomes the basis for the next step in the calculation:

The Sixth Modular Form Calculation

Disk A Inputs: Top Face: $312\frac{1}{3}$, Bottom Face: $313\frac{2}{3}$
Disk B Operators: Top Face: Linear combination, 2Up+1Down
Bottom Face: Linear combination, 1Up+2Down
Disk C Outputs: Top Face: $938\frac{1}{3}$, Bottom Face: $939\frac{2}{3}$ (and see below)

The two linear combinations calculate as follows:

$$\mathbf{2Up + 1Down = 2(312\tfrac{1}{3}) + 1(313\tfrac{2}{3}) = 624\tfrac{2}{3} + 313\tfrac{2}{3} = 938\tfrac{1}{3}}$$
$$\mathbf{1Up + 2Down = 1(312\tfrac{1}{3}) + 2(313\tfrac{2}{3}) = 312\tfrac{1}{3} + 627\tfrac{1}{3} = 939\tfrac{2}{3}}$$

This gives two values for the proton and neutron:

Proton Value: $938\frac{1}{3}$
Neutron Value: $939\frac{2}{3}$

Now write these as decimals, to three places (we use three places, with no rounding, to maintain the symmetry with the three digits in the whole number position; notice that there is no other way to determine where the cutoff should be—this becomes important):

Proton Value: 938.333
Neutron Value: 939.666

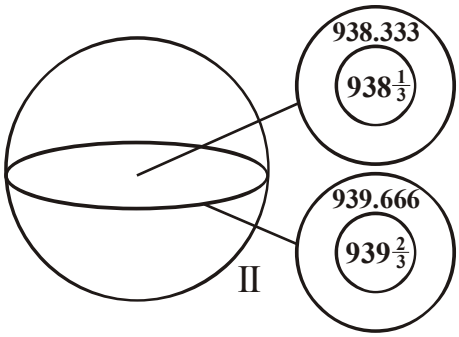
Now compare these intermediate values with the experimentally measured mass forms (three places shown for comparison, no rounding):

Proton Mass: 938.271
Neutron Value: 939.565

This indicates that some kind of correcting values will be added to the values derived so far. This occurs because of the calculations of Column B.

The final state of this output disk is to have two concentric circular regions on each face. The top face has **$938\frac{1}{3}$** (fraction form) in the inner region, and **938.333** (decimal form) in the outer region, showing the proton values. The decimal value goes on to help create the final proton mass value. The fraction form goes on the help create the mass of the electron, as seen later below. The bottom face has **$939\frac{2}{3}$** in the inner region and **939.666** in the outer region, the neutron values (this fraction will also contribute to deriving the mass of the electron). We draw this as the diagram for Line 10, Column A:

Diagram for Line 10, Column A of the Flowchart



The Calculation of Column B

We now move the process to Column B. The seventh Modular Form calculation proceeds from Line 6, Column B to Line 7, Column B:

The Seventh Modular Form Calculation

Disk A Inputs: See diagram on page 66
Disk B Operator: Add the numbers of each ring, both faces
Disk C Outputs: Top Face: 6 2, Bottom Face: -1 0 1

This operator form uses rotation to add the values found in each ring, on both faces. The five calculations are as follows:

1+2+3 = 6
1/3+2/3+3/3 = 2

-1 = -1
-1/2+(+1/2) = 0
1/3+2/3+(±3/3)+0 = 1

The output disk then looks like this:

TOP FACE

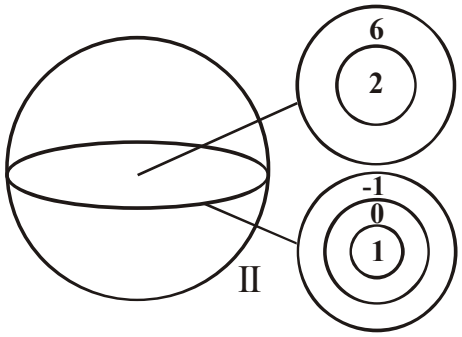
First Ring: 6
Second Ring: 2

BOTTOM FACE

First Ring: -1
Second Ring: 0
Third Ring: 1

We can now view the diagram for Line 7, Column B:

Diagram for Line 7, Column B of the Flowchart



This now becomes the input for the next calculation.

The Introduction of Observer Frames

Each step in the calculation can be described as an observer frame. Notice that looking at three disks in the steps of the calculation on the Modular Form requires observing from three different directions.

The determination of what operators are selected must in the end be seen as a choice of the Intelligent Observer. The overall understanding shows that the universe is Intelligent, and that Observer Mathematics is active in physics (think of how the observer is seen to be present in relativity, and in quantum theory, relative to the "measurement problem").

In the calculations so far we have observed the state of each disk, but the presence of the Observer is not present in the actual calculations that cause change of state. In other words, the operators used so far are not purely about observation, per se. At some point, however, at least one step will be, in order to show the sign of the Observer who sees all of these steps in order, and determines their outcome. The logic is the logic of the Observer. This logic includes a mathematical language, previously undiscovered, that is introduced here for the first time.

The next calculation in the mass derivation involves this Observer action. The operator for this calculation is *writing numbers in sequence as seen by the Observer*; this happens when actual observations of the state that is present are performed by the Observer who can always hold the model in his hands. This means we will join that Observer, and see how the steps of instruction (the "operator") for this step are determined. The purpose of the calculation is to produce a new output state.

The input state for Disk A of this calculation is:

TOP FACE

First Ring: 6
Second Ring: 2

BOTTOM FACE

First Ring: -1
Second Ring: 0
Third Ring: 1

Now the Observer begins a process of thought. That thought displays the Observer's logic for assembling the steps. Picture the Observer as looking at a chalkboard and writing down the thoughts in order (notice that you can recreate this state yourself). The entire sequence of thoughts is a mathematical statement.

The Observer begins by writing the above diagram on the board. Each successive step is then a logical and chosen mathematical change of state. The first such change is to rewrite the diagram in a new way. The Observer summarizes the pattern as a simple dual hierarchy involving *sequence*, with everything communicated in how it is written:

The First Modification,
Ordered Construction

6 2

-1 0 1

This can always be seen and drawn as a II disk state, but this is not emphasized here. We instead think about the pattern. We see these sequences as important because each of the two sequences could become the coefficient set for a specific Base-10 number, and this is the first appearance of that possibility in this column. This is therefore the first observer frame for the next calculation and is labeled as *ordered construction*.

Notice that the observation of this sequential construction proceeds *downward*. The Observer experiences the downward construction state shown above in the following way (an appearance of *ordinal counting*):

1st 6 2

2nd -1 0 1

The two observations of the actual construction are:

First Observation:

6 2

Second Observation:

6 2

-1 0 1

The next observer frame for the calculation will be *ordered application*, and will be based on this ordered construction state, but running the observations *upward*, the complementary direction. The ordering occurs in the ordering of observations made of the steps of construction. Now see the entries in the state above as being on a II disk, with observation coming first from the South pole. The observation will be of the disk from below, looking *up*.

The first observation is therefore of the bottom disk face only (a single state):

-1 0 1

The Observer records this as $\mathbf{S_1}$, a sequence of numbers (the change of state is the new observer notation):

$$\mathbf{S_1 = -1, 0, 1}$$

Now the Observer looks upward again at the twin disk. This time there will be an observation from the South pole *followed* by an observation from the North pole (both sides must ultimately be seen). The numbers **-1 0 1** have already been used, however. A new and distinct observer pathway will therefore appear. To understand what happens we must see one particular step of construction that becomes active in the operator. We can apply counting to the original disk state, and this is what the Observer writes next:

1 6 2

---

2 -1 0 1

This step creates a second value on the bottom face. This value is the sum of **-1 0 1**, which is **0** (addition is the "default" operation when nothing else is present to determine what it should be). We write this as follows, in the extended dual hierarchy form:

6 2

-1 0 1

0

We then write it as sequence for the overall lower level, creating a new dual hierarchy form:

6 2

-1 0 1 0

The Observer now draws a II disk diagram. The top face (single state, no concentric circles) contains **6 2** while the bottom face has an added concentric circle (creating a lower, inner level). The outer ring contains **-1 0 1** and the inner ring contains **0**.

The first observation described above (South pole observation) can therefore be italicized and highlighted as follows, indicating the observation pathway *bottom face/outer ring only*:

6 2

-1 0 1 0

The second observation will therefore be of the complementary pathway (South pole observation, North pole observation), which is *bottom face/inner ring,* followed by *top face*:

6 2

-1 0 1 ***0***

This produces the observed sequence:

0 6 2

which the Observer rewrites as:

$\mathbf{S_2 = 0, 6, 2}$

The Observer has now constructed two numerical sequences by formal observation, which become the output for this calculation (the top and bottom faces of Disk C):

$\mathbf{S_2 = 0\ 6\ 2}$

$\mathbf{S_1 = -1\ 0\ 1}$

Notice that the subscripts proceed *upward*, the frame of observation for this step. The sequence $\mathbf{S_1 = -1, 0, 1}$ enters into the bottom of the output disk state because a bottom state is where it was read from. The nonzero portion of $\mathbf{S_2 = 0, 6, 2}$ was located in the top state, and the resultant continues to occupy the top state after modification.

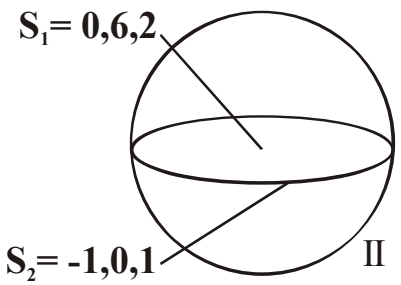
We can now describe the calculation, as determined by the Observer:

The Eighth Modular Form Calculation

Disk A Inputs: Top Face: 6 2, Bottom Face: -1 0 1
Disk B Operators: Apply Observer operators as described above
Disk C Outputs: Top Face: S_1 = 0, 6, 2; Bottom Face: S_2 = -1, 0, 1

We can now draw the diagram for Line 8, Column B:

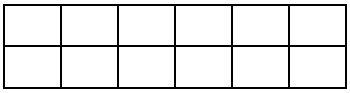
Diagram for Line 8, Column B of the Flowchart



The next calculation will be to turn these number sequences into Base-10 values. This means we must reason out what kinds of numbers they will become.

The first thing we notice is that **0 6 2** must be the coefficients for a decimal, since **0** would not otherwise appear in that position. We know that the derived mass values so far differ by only small decimal amounts from the values measured by experiment. We therefore realize that both sequences will become decimals. This is also fundamental to the distinction between Column A (whole numbers with fractions or decimals) and Column B (decimals only).

We construct the following template as part of the operation for the seventh calculation:



We then place the numbers into the grid as follows:

			0	**6**	**2**
			1	**0**	**1**

The next step is to fill in the decimal notations:

	0	**.**	**0**	**6**	**2**
	0	**.**	**1**	**0**	**1**

We also know that the second number will be negative:

	0	**.**	**0**	**6**	**2**
-	**0**	**.**	**1**	**0**	**1**

Now see a line of symmetry setting the left three grid squares of each line apart from the right three squares. Comparing the squares vertically, we see that the entries in each square to the right of the midline are all different from each other (**0 ≠ 1**, **6 ≠ 0**, **2 ≠ 1**). Two of the three columns to the left of the midline are already equal, and so all vertical squares on the left side must be equal to maintain the common symmetry. This places a negative sign into the last empty square:

-	**0**	**.**	**0**	**6**	**2**
-	**0**	**.**	**1**	**0**	**1**

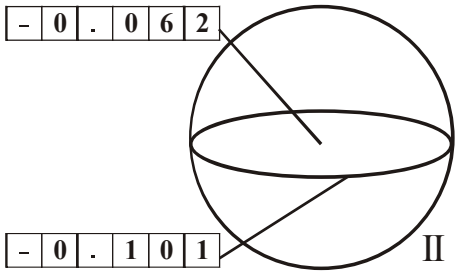
The final appearance of the output in Disk C places each line of the grid on the top and bottom faces, respectively, completing the ninth Modular Form calculation:

The Ninth Modular Form Calculation

Disk A Inputs: Top Face: S_1 = 0, 6, 2; Bottom Face: S_2 = -1, 0, 1
Disk B Operator: Grid operator as described above
Disk C Outputs: Top Face: Grid #1, Bottom Face: Grid #2

We can therefore draw the diagram for Line 9, Column B:

Diagram for Line 9, Column B of the Flowchart



The final calculation is to simply remove the grids and write the numbers as decimal states.

The Tenth Modular Form Calculation

Disk A Inputs: Top Face: Grid #1, Bottom Face: Grid #2
Disk B Operator: Remove grid lines to create final decimal numbers
Disk C Outputs: Top Face: -0.062, Bottom Face: -0.101

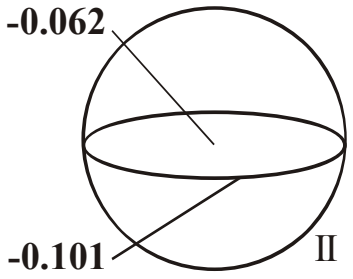
As the numbers become outputs to Disk C, they are written without the grid:

-0.062

-0.101

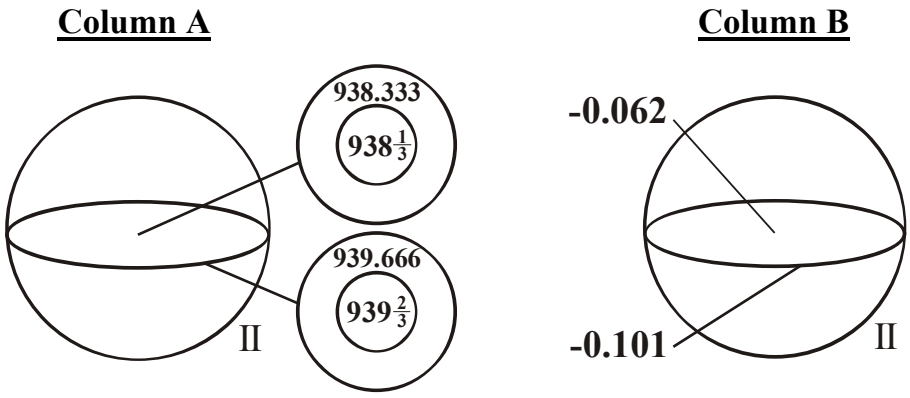
This results in the final diagram for the downward flow of Column B:

Diagram for Line 10, Column B of the Flowchart



We can now bring together all of Line 10:

Diagram for Line 10, Column A and Column B of the Flowchart



Now, two additions are going to take place. They will produce new states that emerge to the left and right of Line 10.

The left hand calculation is as follows. The two whole numbers with fractions found in Column A (**938 1/3** and **939 2/3**) combine to the left to create a new single state disk with the total of **1878**. This will become the first step to deriving the mass of the electron. This step is the eleventh calculation, resulting in Line 10, Column A′ ("A prime"):

The Eleventh Modular Form Calculation

Disk A Inputs: Top Face: 938 1/3, Bottom Face: 939 2/3
Disk B Operator: Add the two face values together
Disk C Output: Top Face: 1878

We will return to the application of **1878** below, and draw the diagram later.

The second addition is of the two decimal values found in the two columns, on the respective top and bottom disks:

938.333 + (-0.062) = 938.271 = Proton

939.666 + (-0.101) = 939.565 = Neutron

Now compare this to the experimentally measured values first shown on page 69 (the first three decimal places shown; no rounding):

Proton Mass: 938.271
Neutron Mass: 939.565

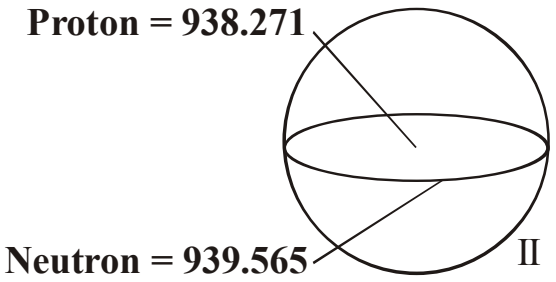
We see that the numbers match exactly. This becomes the tenth calculation:

The Twelfth Modular Form Calculation

Disk A Inputs: Top Face: 938.333, Bottom Face: 939.666
Disk B Operators: Top Face: Add -0.062, Bottom Face: Add -0.101
Disk C Output: Top Face: Proton = 938.271
Bottom Face: Neutron = 939.565

We draw this as Line 10, Column B′, to the right of Column B:

Diagram for Line 10, Column B′ of the Flowchart



There is now one final step of construction remaining for these proton and neutron values. This step involves placing the digits of each derived value in a modular arrangement, for the purpose of extending the digits of the derivation. This becomes the thirteenth calculation:

The Thirteenth Modular Form Calculation

Disk A Inputs: Top Face: 938.271, Bottom Face: 939.565
Disk B Operator: Extend each decimal two digits by making the sequence modular, alpha/omega form
Disk C Output: Top Face: 938.27199, Bottom Face, 939.56533

The new element present here is the alpha/omega form of the modular state. Think of a kitchen clock. We see that **0** starts the sequence at the top position and after full rotation the number **12** coexists with **0** at that position. We start at the top position (beginning, *alpha*) and then return to it (ending, *omega*). We see that **0** and **12** are *distinct* (different numbers), but that in a complementary state they are equal (they occupy the same position on the clock). We must write the following dual statement:

$0 \neq 12$ (Category: Distinct Numbers)

$0 = 12$ (Category: Modular Equality of Numerical Value)

If we draw a diagram for the top position of a kitchen clock it looks like this:

0

12

Or it could be drawn in the opposite form, **12/0**. The application determines the choice.

Now label the diagram like this:

0, Alpha

12, Omega

We use this form in the next derivation step. That step is to place the digits we have so far into the modular alpha/omega form. We start with the value for the proton, **938.271**. We place the first digit, **9**, in the top position, as above, and continue to install the digits as we go clockwise around the circle. The last digit, **1**, comes just before the return to the top position. The top position itself looks like this (no number below yet):

9, Alpha

Omega

We now count this dual hierarchy:

1 9, Alpha

---

2 Omega

We only have the **9** to work with, and it steps down into the lower level:

1 9, Alpha

---

2 9, Omega

Now apply the **2** of the lower level as the doubling of the appearance of **9** in that level:

9, Alpha

---

9 9, Omega

Now, as we read around the circle, we see that the digits are as follows:

938.27199

Compare this to the experimentally measured value for the mass of the proton:

Mass of the Proton = 938.27199 MeV

We repeat this process for the neutron. The final steps again start with the counted dual hierarchy:

1 9, Alpha

---

2 Omega

We must find two digits we can place in the lower level. We only have **9** to work with. The pathway we seek flows from the fact that **9** is a square (a pattern highlighted in a major way within the applications of the new Modular Numbers). We factor **9** as **3**x**3** (note that this again gives two equal digits, something no other simple arithmetic process can automatically create), and insert these two digits as a derivation directly from **9**:

9, Alpha

---

3 3, Omega

Now, as we read around the circle, we see that the digits are as follows:

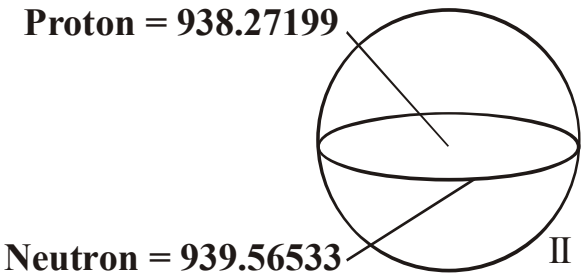
939.56533

Compare this to the experimentally measured value for the mass of the neutron:

Mass of the Neutron = 939.56533 MeV

We can now draw the diagram for these final results, to the right of Line 10, Column B′, at Line 10, Column B″:

Diagram for Line 10, Column B″ of the Flowchart



There are three primary particle attributes that these derived numerical values could be related to: *charge*, *spin*, or *mass*. Charge and spin have derivations of their own that produce completely different kinds of numbers. The only category remaining is *mass*. The final step is the assignment of these values to the *mass* category, by the Observer.

Energy and the Alpha/Omega Form

We can now see a deeper pattern present in Energy. Recall the explanation beginning on page 49 in which Energy was first seen to be the medium state *above* space, followed by the secondary appearance of energy as the *full* state of phenomena appearing *in* space. This is a modular relationship. Begin with the linear sequence:

Energy, Space, Phenomena (energy)

Now place this sequence into the modular alpha/omega form (Energy at the top position, Space in the lower position, and then the return to the top position for energy as Phenomena). The top sector then looks like this:

Energy Medium

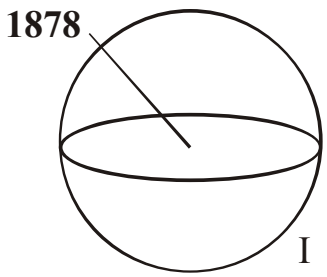
Phenomenal energy

Here, Energy is a unity state while the energy of phenomena appears as discrete states (particles, atoms, and waves) against the backdrop of space. The two states are distinct, and yet because they also occupy the same overall top sector, they must in one case be equal (like the **0** and **12** of the kitchen clock). Count the levels **1 2** and the lower level becomes the two primary categories *matter* and *light*. The equality forms then become $\mathbf{E = mc^2}$ for matter and **E = Nhf** for light.

Deriving the Mass of the Electron

Recall that the eleventh Modular Form calculation (page 78) added **938**$^{1}/_{3}$ and **939**$^{2}/_{3}$ to obtain **1878**, on a I disk, located at Line 10, Column A′. We will now draw that diagram:

Diagram for Line 10, Column A′ of the Flowchart



We note immediately that the mass of the proton is essentially **1836** times the mass of the electron. If this exact value were part of the construction, and it were found within the **1878**, then a partition would be required, giving **1878 = 1836+42**. This turns out to be correct, and the **42** is linked to the quarks. Here is how this is developed.

We classify electrons and quarks as fundamental particles, not containing other particles. They can be linked in a dual state through the following mechanism. List the main particles of the atom in the order of their appearance, proceeding downward by levels into the atom:

Electron
Proton
Neutron
Quarks

Now place this category sequence in the modular alpha/omega form. The top position has a dual condition, with **Electron** on top:

Electron

The states **Proton** and **Neutron** proceed clockwise around the circular disk, with **Quarks** appearing as the omega state in the dual top position:

Electron

Quarks

This pairs these two categories as a unit, the fundamental particles. Again, there is a *category arithmetic* active in the laws of nature.

Now examine the quarks in further detail. We know that there are exactly **6** quark archetypes (up, down, charm, strange, top, bottom). Each of these has a spin of **±1/2**. We then realize that the Pauli Exclusion Principle, stating that no two spin 1/2 particles of the same sign can occupy the same quantum state, will require that there be three "colors" for each of the three quarks of a nucleon. Further, we must be able to create antimatter quarks. This means that there will be a total of **36** quark states. The first state is the set of **6** quark flavors, spin **±1/2** (no colors yet, *ordered construction*):

The 6 Quark Flavors with Spin ±1/2

Up, Down
Charm, Strange
Top, Bottom

This is then extended to become the form of *ordered application*, with **36** states [matter and antimatter, with colors present as Red (R), Green (G), and Blue (B)]:

The 36 Quark States

18 Matter Forms

$\mathbf{U_R\ U_G\ U_B\ \ D_R\ D_G\ D_B}$
$\mathbf{C_R\ C_G\ C_B\ \ S_R\ \ S_G\ \ S_B}$
$\mathbf{T_R\ T_G\ T_B\ \ B_R\ B_G\ B_B}$

18 Antimatter Forms

$U_R\ U_G\ U_B\ \ D_R\ D_G\ D_B$
$C_R\ C_G\ C_B\ \ S_R\ \ S_G\ \ S_B$
$T_R\ T_G\ T_B\ \ B_R\ B_G\ B_B$

Each of these is a single category state, *with no numbers involved*. The number of single states required is **6+36 = 42**. This is a counting of the categories.

The number **1878** is assigned to the following overall state:

Electron

Quarks

It splits into two values, creating this:

1836 Electron

42 Quarks

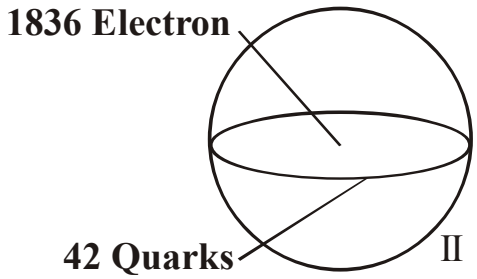
This is a dual state, requiring a II disk, and this step becomes the fourteenth calculation:

The Fourteenth Modular Form Calculation

Disk A Inputs: I Disk, Top Face: 1878
Disk B Operator: Partition into 1836 and 42
Disk C Output: II Disk, Top Face: 1836, Bottom Face: 42

We can now draw the diagram for Line 11, Column A′, just below Line 10, Column A′:

Diagram for Line 11, Column A′ of the Flowchart



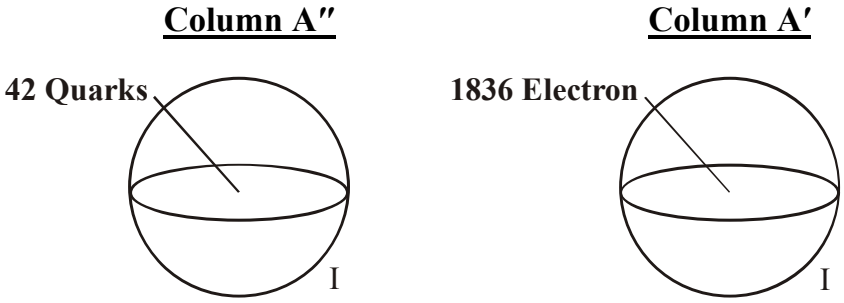
We now need to separate these two states. We want the electron mass calculation to continue down Column A′. The quarks will be set aside to the left, becoming the entry for Line 12, Column A″. We split the II disk into two I disks. This becomes the fifteenth Modular Form calculation:

The Fifteenth Modular Form Calculation

Disk A Inputs: Top Face: 1836, Bottom Face: 42
Disk B Operator: Split II disk into two I disks
Disk C and C′ Outputs: C Top Face: 1836, C′ Top Face, 42

In this case the output Disk C splits to become the I disks of the two new states. We can now draw the diagram for Line 12, Column A′ and Column A″ (Column A″ is to the left of Column A′):

Diagram for Line 12, Columns A″ and A′ of the Flowchart



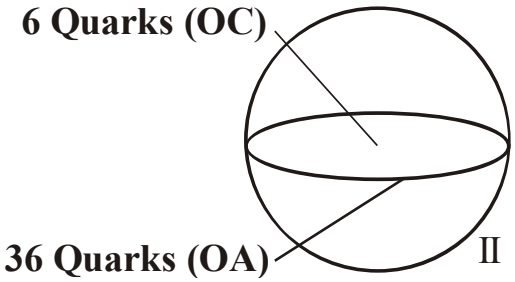
The next step is to split the state **42 Quarks** into **6** constructed archetypes on the top face and the **36** applications on the bottom face. This becomes the sixteenth Modular Form calculation:

The Sixteenth Modular Form Calculation

Disk A Inputs: Top Face: 42
Disk B Operator: Partition 42 as 6+36
Disk C Outputs: Top Face: 6, Bottom Face: 36

This leads to the diagram for Line 13, Column A″ (the abbreviation "OC" means *ordered construction* and "OA" means *ordered application*):

Diagram for Line 13 Column A″ of the Flowchart



The quark pathway is completed at this point. We now return to the downward extension of Column A′, at Line 13. Directly above we have the single disk with **1836 Electron**. To further develop this we must link the electron with the proton. To do that we list the three primary atomic particles in the following way:

Electron, -1
Neutron, 0
Proton, +1

Notice that this corresponds with the number line's ordered sequence of **-1**, **0**, **+1**. Now place this sequence in the modular alpha/omega form. The result is that the top sector looks like this:

Electron

Proton

The state couples these two categories in this way because they have nonzero charge, and this is the direct relationship of the active electric charge interaction within the atom. Now install the constructed state **1836 Electron**:

$$\frac{\textbf{1836 Electron}}{\textbf{Proton}}$$

These two states occupy the same top position in the modular form and must in one case be equal. Equate the two levels:

$$\textbf{1836 Electron} = \textbf{Proton}$$

Now solve for **Electron**:

$$\textbf{Electron} = \frac{\textbf{Proton}}{\textbf{1836}}$$

The "proton number" is the final proton mass value, which we insert here:

$$\textbf{Electron} = \frac{\textbf{938.27199}}{\textbf{1836}}$$

$$\textbf{Electron} = \textbf{0.51104 . . .}$$

Now recall that the derivations for the proton and neutron went in two stages relative to the decimal sequences. First three digits were produced, then two more. We apply this same requirement here. This step in the electron mass derivation allows the computed decimal to proceed to only three decimal places:

$$\textbf{Electron} = \textbf{0.511}$$

Now we ask how two new digits could be added. We cannot obtain new digits from the modular alpha/omega form because the first digit here is **0**.

The only way to proceed is to change the second **1** to the unbounded **0.9999 . . .** form. The second **1** above is in the thousandths place, leading to this:

$$\textbf{0.001} = \textbf{0.0009999 . . .}$$

The derived value then becomes:

Electron = 0.5109999 . . .

We now limit the new digits to two, as before (noting that the process has also changed the third digit):

Electron = 0.51099

Now compare this to the experimentally measured value for the mass of the electron:

Mass of the Electron = 0.51099 MeV

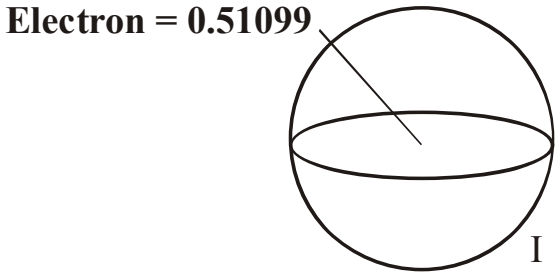
We see that these steps constitute the seventeenth Modular Form calculation:

The Seventeenth Modular Form Calculation

Disk A Inputs: Top Face: 1836 Electron
Disk B Operator: See description above
Disk C Output: Electron = 0.51099

We then draw the diagram for Line 13, Column A′:

Diagram for Line 13 Column A′ of the Flowchart



As a final step for the masses of the three primary atomic particles, we can combine Line 10, Column B″ with Line 13, Column A′ to create a single Modular Form with three I disks (another application of the Modular Form, with the disks again labeled A, B, and C), all giving the masses of the three particles in MeV (a new and larger derivation of the state "MeV" can be done and formally combined with these steps, but this will be omitted from this introduction):

Masses of the Proton, Neutron, and Electron
as Shown on a Single Modular Form

Disk A: Mass of the Proton: 938.27199 MeV
Disk B: Mass of the Neutron: 939.56533 MeV
Disk C: Mass of the Electron: 0.51099 MeV

The Experimental Data Used by the National Institute of Standards and Technology

From 1998 to December 2003 the United States Government's National Institute of Standards and Technology (website www.nist.gov) provided these CODATA values to the scientific community for the masses of the three primary atomic particles (five decimals shown here):

Masses of the Primary Atomic
Particles as Presented by the NIST

Mass of the Proton: 938.27199 MeV
Mass of the Neutron: 939.56533 MeV
Mass of the Electron: 0.51099 MeV

These match the derivations provided here exactly. In December 2003, based on revisions to the CODATA information, the values for the masses of the proton and neutron were slightly changed (the value for the electron remains the same). The changed values give the mass of the proton as 938.27202 and the mass of the neutron as 939.56536. The derivations show, however, that these changes should not have been made, and that the values are now inaccurate. The original values were completely correct (they are archived at the website.)

A Note about a Further Pathway that Leads to Planck's Constant

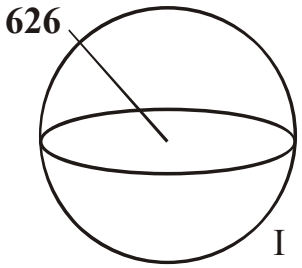
There is one further addition state that can be added to the flowchart. Recall Line 9, Column A (page 68). At that step we had derived the two quark basis values of **312 1/3** and **313 2/3**. The addition of these values creates a new single state form to the left, at Line 9, Column A′, from the eighteenth Modular Form calculation:

The Eighteenth Modular Form Calculation

Disk A Inputs: Top Face: 312 1/3, Bottom Face: 313 2/3
Disk B Operator: Add the two face values together
Disk C Output: 626

We can then draw the diagram for Line 9, Column A′:

Diagram for Line 9 Column A′ of the Flowchart



When this is extended in the next step to the left, the digits are placed in the alpha/omega form. In this case we simply duplicate the first **6** at the top position to extend the digits to **6266** (the alpha **6** above steps down into the omega state below, extending the sequence). Further development leads to the numerical value for Planck's constant, $\mathbf{h = 6.266x10^{-34}}$. These added steps will be omitted here, but will appear in a future publication.

Conclusion

This presentation is drawn from a massive volume of new mathematical and scientific material discovered over the past 10 years, but unpublished. The derivation of other constants of nature (such as the speed of light, the gravitational constant, and so on) are included in this body of information. Many other results relating to all aspects of physics have also been discovered, and these discoveries significantly revise our overall understanding of the laws of nature and the mathematical patterns that create them.

The understanding opens a major dialogue on the foundations of mathematics and science. It provides a complete and comprehensive Observer Mathematics, something that has never been developed before. Real progress in understanding the laws of physics requires this mathematical system.

The defining characteristic of the understanding is that it displays the highest forms of simplicity. It satisfies the aesthetic criterion which holds that final truth should be simple, elegant, and beautiful. It shows that there are simple mathematical patterns and objects that have gone overlooked, and that these patterns are precisely the ones that combine to directly produce the laws of nature.

This paper is about the constants of nature. No understanding of physics prior to this has ever provided any insight into how these constants are determined. The fact that this understanding derives the constants directly is a major indication that the understanding is correct.

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Part Four

Prime Numbers and the Electrons of the Atom

Prime Numbers and the Electrons of the Atom

MARK PROVO

ABSTRACT

The simple derivation for the numerical patterns of the electron orbitals and electron shells is provided. This structure is shown to be based in the prime numbers. Important to the understanding is the fact that, for nature, 1 is a prime number. The reasons that elements 43 and 61 fall out of the periodic table is also discussed.

It is now clear that the greatest unsolved problem in chemistry, and therefore also one of the greatest unsolved problems in physics, is the question of how to scientifically derive the atom from first principles. Chemistry textbooks report many facts *about* the structure of the atom ("the p orbital can hold up to six electrons," and so on), but are unable to provide the *why* behind these facts. For example, in examining the periodic table we discover that, as nature makes atoms, it does so such that they proceed as the atomic number, the number of protons, increases (Hydrogen = 1, Helium = 2, Lithium = 3, and so on). But then, element 41, Technetium, is not made. The counting of actual elements then resumes and this sudden gap effect is created again with element 61, Promethium, which also fails to appear in nature (both of these elements have been created for brief times in the laboratory, but they are not made by nature itself). The question of why these elements fall out of the periodic table has never been answered. In fact, the fundamental structure of the atom, in general, has never been derived at all.

Other questions of this type confront the reader of a chemistry textbook. *Why* are there exactly seven electron shells? Why are there four primary orbitals (*s*, *p*, *d*, *f*), and why do they contain up to 2, 6, 10 or 14 electrons respectively? [One standard university chemistry textbook makes a note in discussing this topic by saying that 'it is not known if there is a *g* orbital with 18 electrons.' This shows that the fact of there being exactly four (and only four) orbitals has not even been recognized.

This paper will provide the derivation for the electron orbitals and electrons shells of the atom. The primary basis for constructing the electron orbitals and electron shells is found in the prime numbers. This originates from the two ways we can partition the natural numbers into two sets. The first way is to make the distinction between *prime* and *composite*, and the second is to distinguish between *even* and *odd*.

Before we can work with prime numbers, however, we must understand something important about them. It is the current opinion of mathematicians that **1** is not a prime number, but this is completely incorrect. This opinion has been created because of the fundamental theorem of arithmetic, which states that every composite number must be seen as having a unique prime factorization. The inclusion of **1** as a prime number is seen as removing the uniqueness property, and so **1** is removed from the prime numbers. But we should realize it may be possible that nature does not care about the fundamental theorem of arithmetic as presented in number theory. The fact is that **1** *is* a prime number *for nature*, and this will be proven in the very structure of the atom itself. What is especially crucial about this is the fact that the first three prime numbers are then:

1 2 3

The fact that these numbers start at **1**, are successive, and are all prime is of the greatest possible importance for the overall structure of physics generally, and the structure of the atom specifically (*Derivation of the Masses for the Proton, Neutron, and Electron* makes this clear). This prime sequence is the deeper significance of space being three-dimensional:

1 2 3
X Y Z

It is also the reason that so many physics phenomena appear in groups of three (three states for matter as solid, liquid, and gas, three types of chemical bonds as single, double, and triple, three primary colors as red, yellow, and blue, and so on). In general, this makes the set of prime numbers a basis element for the laws of physics.

We begin with the natural numbers:

Natural Numbers: 1 2 3 4 5 6 7 8 9 10 . . .

Now distinguish between prime and composite numbers:

Prime: 1 2 3 5 7 11 13 17 19 23 . . .
Composite: 4 6 8 9 10 12 14 15 16 18 . . .

Next distinguish between even and odd:

Odd: 1 3 5 7 9 11 13 15 17 . . .
Even: 2 4 6 8 10 12 14 16 18 . . .

Now examine the nature of subatomic particles. Most are either single fundamental particles (electrons, neutrinos, quarks) or composite particles that contain quarks inside

(protons, neutrons, etc.). This means that "fundamental" particles are actually *prime particles*. This also means that they will be governed by the prime numbers. This will be proven correct here for the electrons.

To begin the construction of the electron orbitals, look more closely at the first few entries in the prime number sequence:

1 2 3 5 7 11 13

Apply the even/odd distinction to this list and the result is a dual hierarchy (unity state in the top level; multiple state in the bottom level):

EVEN: 2

ODD: 1 3 5 7 11 13

Inspection of the lower sequence shows it to be successive odd numbers up to **7**. Use this restriction to limit the lower sequence so that successive odd numbers are maintained:

2

---

1 3 5 7

We now use the sphere with single circular disk, at the equator (II disk form), to provide geometric residence for these numbers. In the first step of construction the top face has a single value only and the bottom face has four sectors:

TOP FACE: 2

BOTTOM FACE: 1 3 5 7

The appearance of **2** in the senior position creates the orbital state itself, a quantum state that can contain up to two electrons (where **2** = **1+1** is active, creating **1 1** as the counting of each electron present). The prime numbers in the bottom level will determine how many forms of an orbital can exist for each of four primary states.

This dual hierarchy is the downward observer frame, a state of *ordered construction* in the category *number*. The upward frame will complement this as a form of *ordered application* in the complementary category *geometry*. It will cause the pattern of the bottom face (four geometric sector divisions) to appear in the top face. The result is that there will be four sectors on the top face each containing the value **2** (just as cutting a pizza into slices creates slices that are still "pizza"):

TOP FACE: 2 2 2 2

BOTTOM FACE: 1 3 5 7

The four orbital states of **2** must be distinguished, and renamed for that purpose. These become ***s***, ***p***, ***d***, and ***f***, each shown with a subscript **2** to indicate the orbital state itself which has room for two electrons:

TOP FACE: s_2 p_2 d_2 f_2

BOTTOM FACE: 1 3 5 7

Recall that this is a II disk form. The next step in construction is to change the II disk to a I disk, where each new single sector state is created by multiplying the complementary sectors shown above. The result is:

$1s_2$ $3p_2$ $5d_2$ $7f_2$

The total number of electrons for each orbital state is therefore:

$1s_2$	**$3p_2$**	**$5d_2$**	**$7f_2$**
2	**6**	**10**	**14**

Notice that there cannot be a "*g*" orbital containing 18 electrons because that would involve a basis number of 9, which is odd but not prime.

To now create the electron shells we combine the orbitals above in a hierarchical fashion:

4th Shell: *spdf* = 2+6+10+14 = 32
3rd Shell: *spd* = 2+6+10 = 18
2nd Shell: *sp* = 2+6 = 8
1st Shell: *s* = 2 = 2

This pattern will be extended in a moment to create the 5th, 6th, and 7th shells, but first we must stop to examine an implication of this pattern. The number sequence **2 8 18 32** exists on a circular disk. Rotation will create addition so that we obtain:

2+8+18+32 = 60

Place this in a circular disk as sixty appearances of **1**. The top sector will be dual, however, like a kitchen clock, with **0** appearing there also. Now start at **the number one position** (see page 66), rotate and add, giving the sequence **1** through **60**, where **60** and **0**

share the new top sector. The final step is to go from **60** to the **0** position, which will be the 61st step. This means that, here:

61 = 0

It is for this reason that element 61 falls out of the periodic table sequence and is not made by nature.

Now return to the original state of the I disk containing **2 8 18 32**. As a step of mathematical construction, we now *change state* to a II disk form, such that we duplicate the numbers on the bottom face. (To draw a diagram of this, use a circle with an X-type arrangement creating four sectors. Place **2** in the top sector, and then proceed clockwise with the remaining numbers.) The bottom face will have the same numbers, except for the **2**. Since the top sector has a dual state containing **0**, that value will replace the **2** in the bottom face form. The sequences look like this to the observer reading the two disk faces (a hand-held model made with a paper disk is helpful to see this):

2 8 18 32 (Starts at top position)
32 18 8 0 (Starts at number one position)

Now change state again to go back to the I disk form. The result is a single sequence wrapped around the disk with a dual value at the top sector:

2(0) 8 18 32 32 18 8

The **0** accounts for why there is no eighth electron shell. Notice, in fact, that the number **8** (following in sequence after the 7th shell) creates **the octet rule**.

Now view the hierarchy in an ascending form:

7th Shell: 8
6th Shell: 18
5th Shell: 32
4th Shell: 32
3rd Shell: 18
2nd Shell: 8
1st Shell: 2

A simple pattern applied to this ascending hierarchical form results in the calculation of the number **42**. From this is constructed the state **43 = 0**, eliminating element 43 from nature's construction pattern. The details of this will be presented in a publication of the future, as part of the complete scientific derivation of the atom.

The Future of this Work

The material presented in this book is selected from a far larger body of new understanding developed by me over the past ten years. I have a degree in mathematics from the University of Washington, and I was Chairman of the Mathematics Department at The Overlake School in Redmond, Washington. This work began when I started having unexpected insights into mathematics and science, in 1994. As these early ideas were developed it soon became apparent that I was discovering the details of how the universe actually operates. This work required a profound immersion of my attention, and enormous concentration. It required that I devote myself full-time to the realization of the understanding, for two reasons. First, the pace of discovery was rapid and extremely involved, requiring tens of thousands of hours on the writing pad. And second, I saw how important the applications of this new awareness will be, in every area from mathematics and science to education, medicine, technology, and even daily life.

During these years I made over 1250 attempts to contact people and institutions of every conceivable kind throughout America, with a request for evaluation and funding. In not one case was I ever heard or taken seriously in any way. No one ever evaluated the discoveries, or spoke to me in any way. Each person or institution found a reason to ignore or dismiss what I was saying in my letter of introduction. As a result, I have lived on extremely meager income for all this time. This book has been prepared so that my work can be recognized and supported. To produce this book I had to receive help from a supporter to pay to have the diagrams made. I do not have a modern computer or any graphics software.

I have given you the book for free, as a gift. If you feel supportive of what you have read, I ask for you to consider providing me with a gift in return. I need contributions that can allow me to develop this material into proper presentation forms, and to create a new scientific research institute devoted to its study and application.

Here is what you will see in the future, if such funding is provided: First, you will be able to see the full presentation of exactly what constitutes Scientific Grand Unification, in book form, in computer programs, and on animated videotapes. Second, you will be able to directly participate in the application of this new understanding, in one or more ways. And third, you will be supporting work that is entirely motivated by a humanitarian impulse whose purpose is to improve the state of the world. As it turns out, this knowledge is a key requirement for creating a better future for all people of the world. This will be proven to be correct as time unfolds. The new understanding is very broad, and covers every aspect of physics and life. The first step I will take when funding is received is to create a major website where everyone can have a daily interaction with the material as it is developed and presented.

Please send your contribution, in the form of a postal money order if possible, to:

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My email address is modularmathsci@aol.com. Write to me there and I will provide you with an information packet about this work. I am willing to speak to serious people by phone, arranged first by email.

Thank you for all of the time you have invested in reading the book, and for any help you can provide.

Mark Provo