

# The Unit Electrical Matter Substructures of Standard Model Particles

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# Introduction

This presentation is a very brief summary of the steps required to deduce the unit electrical matter substructures of Standard Model fundamental particles.

The detailed explanation of the steps of deduction have been reviewed extensively. With the incorporated suggestions, that detailed explanation should now be worded correctly technically.

This presentation basically skips to the result and then moves on to explanations allowed by the result.

There are two parts to the deduction. This presentation covers Part 1, the deduction of the unit electrical matter substructures of Standard Model particles. The consequences of Part 1 are extremely interesting. However, we need to agree on the unit electrical matter substructures of Standard Model particles before we look at the consequences.

I understand how this will appear at first. Hopefully, the reader will be intrigued enough to read until they can find a conflict with the known facts and will be stuck, like I was, trying to find a problem. There are no problems to be found. In fact, the concept explains wave-particle duality.

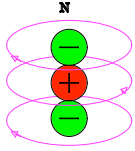
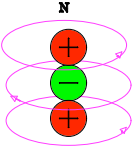
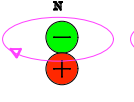
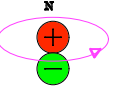

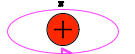
Please assume that I understand all aspects of quantum mechanics and that I understand all of the laws of conservation.

I am very confident that the logic presented is consistent with all observational science and with the mathematics of the natural forces. In fact, this theory is nothing more than a physical interpretation of the mathematics of the natural forces.

James Rees

October 2007

# Table of Contents of The Unit Electrical Matter Substructures of Standard Model Particles

						
Particle	Down	Up	Neutrino	Anti-Neutrino	Electron	Positron
Symmetry	SU(3)	SU(3)	SU(2)	SU(2)	U(1)	U(1)
Spin	1/2	1/2	1/2	1/2	1/2	1/2
Charge	-1/3	+2/3	0	0	-1	+1

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5. Result #1 - Triplet Unit Electrical Matter Substructure within Quarks
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15. Appendix A - Example Particle Decays

blue = known observational fact  
green = physical interpretation of the mathematics of the natural force  
purple = new identification

# Overview

## The deduction of **Unit Electrical Matter Substructures** of Standard Model Particles from the Observational Facts

How I deduced the Unit Matter Substructure of the Standard Model Particles: from the properties of the Standard Model Particles.

How I verified the Unit Matter Substructure of Standard Model Particles: 1) by checking against every physical observational fact 2) by realizing that the physical significance of the math of QCD & the math of the weak force already indicated the unit substructures.

### The Steps of Deduction from the Observed Facts

#### The Clue

1. Quark Fractal Electric Charge
2. Neutrino Spin Helicity

#### The Conclusion

- Triplet unit charge substructure
- Doublet unit charge substructure

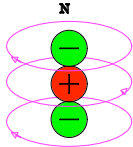
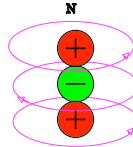
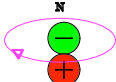
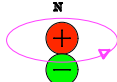

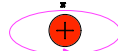
Explanation of the steps of deduction on the next slides. 'Substructure Rules' slide explains the results (slide 12).

### Physical significance of the math of the natural forces: SU(3), SU(2), U(1) Symmetry.

1. SU(3) symmetry of the Strong force indicates a triple set of axes of common complex energy rotation.
2. SU(2) symmetry of the Weak force indicates a double set of axes of common complex energy rotation.
3. U(1) symmetry of the Electromagnetic force indicates one set of axes of common complex energy rotation.

The number of units in the unit substructure of the particle matching the number of axes of symmetry of energy rotation of the associated force is very telling.

## Unit Electrical Matter Substructures of Standard Model Particles

						
Particle	Down	Up	Neutrino	Anti-Neutrino	Electron	Positron
Symmetry	SU(3)	SU(3)	SU(2)	SU(2)	U(1)	U(1)
Spin	1/2	1/2	1/2	1/2	1/2	1/2
Electric Charge	-1/3	+2/3	0	0	-1	+1

Explains wave-particle duality !!! (slide 14)

# Clue #1 Quark Fractional Electrical Charge

	Electric Charge
Up Quark	+2/3
Down Quark	-1/3
Anti-Up Quark	+1/3
Anti-Down Quark	-2/3

Mathematically, fractions indicate ratios of units. **The mathematics of quark fractional electric charge can not logically be ignored.** Mathematical logic dictates that quark fractional electrical charge indicates an electrical substructure within quarks composed of units of electrical charge with 3 total units.

This group is 2/3 **positive** electrical units  
 This group is +1 overall  
 $2/3 \times +1 = +2/3$  positive matter

Up Quark

This group is 1/3 **positive** electrical units  
 This group is -1 overall  
 $1/3 \times -1 = -1/3$  positive matter

Down Quark

A symmetry is immediately obvious. **Quark fractional charge is immediately obvious as a form of group mathematics.**

There are only two configurations of a group of three unit electrical charge particles possible. Since the units of positive and negative matter can only form two groups of three units, the anti-up and anti-down quarks must be accounted for with just the two 3 unit configurations.

This group is 1/3 **negative** electrical units  
 This group is +1 overall  
 $1/3 \times +1 = +1/3$  negative matter

Anti-Down Quark

This group is 2/3 **negative** electrical units  
 This group is -1 overall  
 $2/3 \times -1 = -2/3$  negative matter

Anti-Up Quark

Quark fractional electrical charge is group math where we track the type of unit charge the target proton is in the numerator. The group is the denominator. For normal matter, we track positive units in the numerator. For anti-matter, we track negative matter in the numerator.

Matter	Anti-Matter
Positive Matter Ratios	Negative Matter Ratios
Up = +2/3	Anti-Up = -2/3
Down = -1/3	Anti-Down = +1/3

# Result #1 Quark Triplet Unit Electrical Charge

Quark Triplet  
Unit Electric Charge  
Substructure



Up



Down

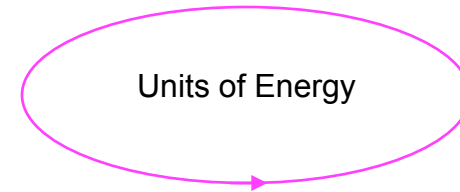
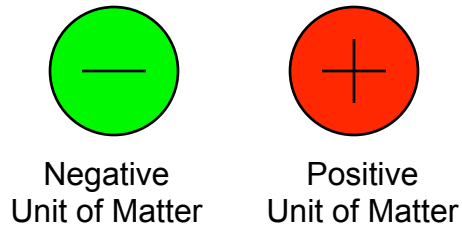
We are forced by the fractional charge of quarks to conclude that up and down quarks have a triplet of centers of unit electrical charge within their structure, and to conclude that quarks have at least two components; **units of electrically charged matter** and **units of energy**.

The immediate implication if quarks had the mathematically dictated triplet of unit electrical charge centers of matter within their structure is that there would be a new distinction among components of quarks, the components being:

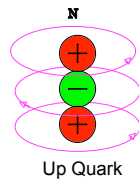
**electrically charged units of matter**

and

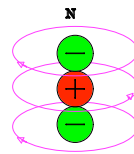
**units of energy.**



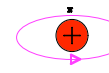
The math of QCD is tracking energy in complex rotation about 3 poles of charge, i.e., the tripolar charge of the strong force.



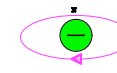
Up Quark



Down Quark

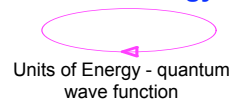
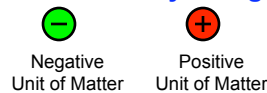


Positron



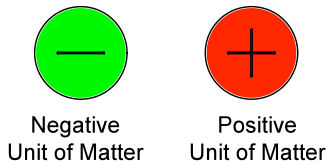
Electron

Up & down quarks, and electrons & positrons illustrated as composed of **units of electrically charged matter** and **units of energy**.

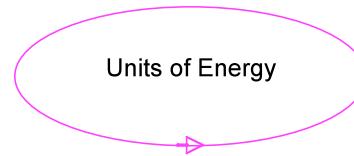


# New Entity Identified - Units of Electrical Matter

It is important to understand the next clue that it be clear that there are now two identified components of quarks, the two components being **electrically charged units of matter** and **units of energy**.



- Unit Matter Properties:
- possess an electrical field
  - does not possess mass-energy



- Unit Energy Properties:
- possess mass-energy
  - does not possess electrical charge

The **energy loop** represents the complex 'motion' described by the quantum mechanical wave function.

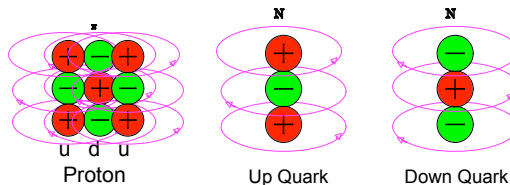
## The mathematics is unarguable.

$E=h\nu$  indicates that energy is composed of units.

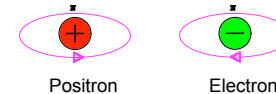
$E=mc^2$  indicates that mass and energy are interchangeable.

Quark fractional charge dictates a 3 unit electrical charge substructure within quarks.

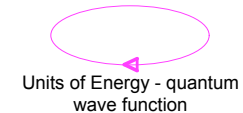
A triplet of triplets composing a proton gives a 3x3 matrix of poles around which to track energy by phase, i.e., the Eight Fold Way. Eight of the units are mutually neutralized with one units worth of electrical field un-neutralized.



U(1) symmetry of electromagnetic interactions between charged particles is due to the energy of the particle being in complex rotation about a single set of axes.



A proton, up & down quarks, and a positron and an electron illustrated as composed of **positive and negative electrically charged units of matter** and **units of energy**.

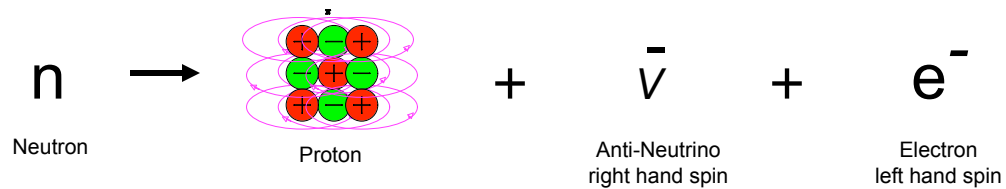


# Clue #2 Neutron Decay and Neutrino Helicity

	Electric Charge	Quantum Angular Momentum
Neutrino	0	1/2 left hand spin
Anti-neutrino	0	1/2 right hand spin

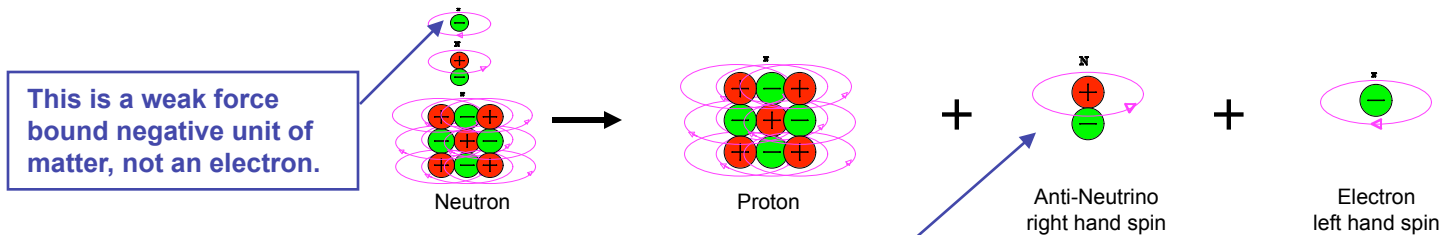
The first thing one would do to determine if quarks had the mathematically dictated unit electrical charge centers of matter within their structure would be to follow particle decays to see if the idea was already known to be incorrect. **The next clue is anti-neutrinos only exhibit right hand spin.**

Let's examine neutron decay as an example of a weak force particle decay.



The magnetic dipole moment of a neutron indicates there is a negatively charged shroud around the neutron, which is an incredibly strong indicator that the neutron has an electrical substructure. The fact that a neutral neutron even has a magnetic dipole moment is an incredibly strong indicator that the neutron has an electrical substructure. The negatively charged shroud could be explained as the folding of a weak force bound negative unit of matter's electrical field over the positive proton's particle core via the weak force bond between the proton and the bound negative unit of matter.

Initially, one could speculate that the neutron was a proton plus a weak force bound single negative unit of matter making the composite neutron particle neutral, while speculating on leaving the decay product of the anti-neutrino to be some form of a neutral unit of matter. **In the end however, to get the particle decays to work out correctly, and with the SU(2) symmetry of the weak force decay in mind, one is forced to consider the possibility that neutrinos are composite structures composed of two oppositely charged unit electrical charge centers of matter bound together to form a neutral particle.**



**Only the energy component contributes angular momentum, not the two units of electrical matter. Neutrinos only have one set of energy bound in rotation about the electrical substructure, therefore the angular momentum is 1/2. The particle diagrams are intended to distinguish mass-energy from units of electrical matter as particle components, and to track each particle component, energy and matter, separately.**

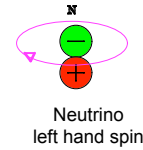
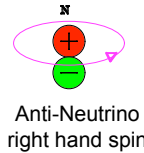
**This has been a stumbling point for reviewers! This is also what has kept people from figuring it out. One has to distinguish energy and electric charge as particle components to see the pattern.**



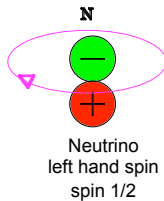
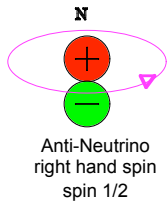


# Result #2 The Doublet Unit Matter Substructures

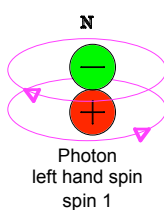
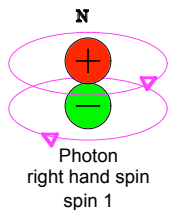
Neutrino Doublet Unit  
Electrical Charge  
Substructures



The clue is anti-neutrinos only exhibit right hand spin, are neutral, and have zero rest mass. The result is this, after working through the particle decays and in order to complete the unit matter substructure pattern, it becomes obvious that neutrinos must have a doublet unit matter substructure. The reason is doublet substructures have zero rest mass, as explained on the next slide. The only difference is a neutrino has one set of energy rotation bound to the substructure and a photon has two sets of energy rotation bound to the substructure. The pattern is complete. All of the Standard Model Fundamental particles can be demonstrated with unit electrical charge, unit matter substructures.



Two oppositely charged units of electrical charge in one structure, but they do not annihilate? This was a difficult concept to accept. However, I had to finally accept the doublet substructure exists due to what it explains, a zero rest mass substructure (explanation on next slide). The initial driving idea was, since quarks are triplets, if neutrinos were doublets, it would mean the Standard Model fundamental particles sans photons were all made from just two components, units of energy and units of electrical matter.



This is a generic representation of a photon composed of a doublet unit electrical matter substructure and two sets of bound energy (i.e., two sets of energy of spin 1/2 = spin 1).

I really don't need to include photons in this presentation, but I might as well let the cat out of the bag. It took a long time to accept that a photon could have an unit electrical matter substructure, as I was taught to think of photons as pure energy. In this scheme however, the electrical charge oscillating in the photon has to come from somewhere as energy is not the source of electrical charge. The source of electrical charge is the units of electrical matter. In photons, the bound energy is in rotation about the units of electrical matter of the photon substructure, energizing those unit matter electrical fields.

Photons are basically a pair of units of energy in counter rotation about a pair or doublet of unit charge centers of electrical matter, with the frequency being related to the number of pairs of energy units bound to the electrical substructure.

See slide 12 - Structure Rules  
See slide 11 - Neutral Pion Decay

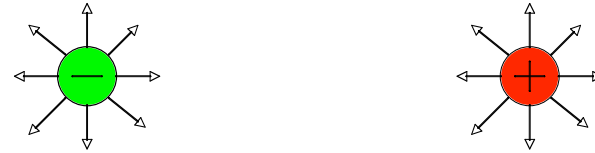
# Unit Matter Electrical Field Configurations

## Definitions: **Open and Closed Lines of Force**

- An Open Electrical Field Line of Force is defined as an electrical line of force that is NOT terminated in an opposite charge line of force.
- A Closed Electrical Field Line of Force is defined as an electrical line of force that is terminated in an opposite charge line of force.

## Electromagnetic Interaction: **Mainly open lines of force interacting**

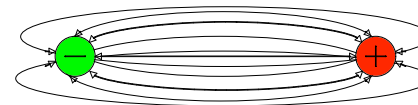
- Open electrical field lines radiate outward
- Open electrical field lines interact in  $1/r^4$  proportion with another electrical field



2 singlets of charge interacting electromagnetically

## Doublet Substructure: **All electrical lines of force folded and closed**

- No internal energy can be stored in the doublet substructure because the electrical lines of force are all completely folded closed and neutralized.
- **Rest mass is internal structural energy hosted by a particle's electrical substructure.**
- The doublet substructure cannot trap energy in the lines of force, therefore the doublet substructure cannot have rest mass.
- Modeled on the annihilation of a positron and an electron which have to align magnetically to annihilate, in which all of the energy of the annihilating pair is measured in the resultant decay product photons. After the positron/electron pair align magnetically, then their electrical fields can collapse (fold) into one another.

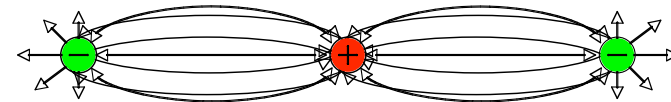


Doublet Substructure

The consequences of the permanent nature of the units of matter is the subject of Part II.

## Triplet Substructure:

- 1/2 closed electrical field lines which are mutually folded into a unit of opposite charge.
- A triplet is unstable and does not exist outside of being bound within a particle
- A triplet would have one unit worth of electrical field lines of force open



Triplet Substructure

- A triplet of triplets would leave one unit worth of electrical field lines of force open (fermion)
- 2 triplets forming a neutral pion would have zero open electrical lines of force (boson)

## Strong Interaction: **Mainly closed lines of force interacting**

- As the two charges connected by the closed lines of force near, the lines of force are neutralized and the attraction diminishes as the distance diminishes, just like asymptotic freedom.
- As the two charges are separated, the closed lines of force are stretched, which requires greater force, just like the strong force.

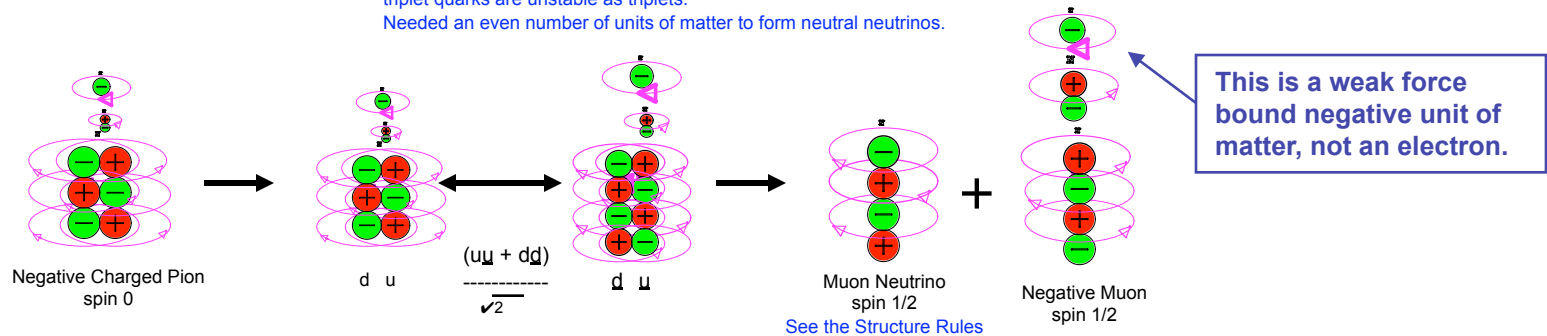
# Charged Pion Decay - Unit Matter Substructures

Speculated structure of Muon Neutrinos

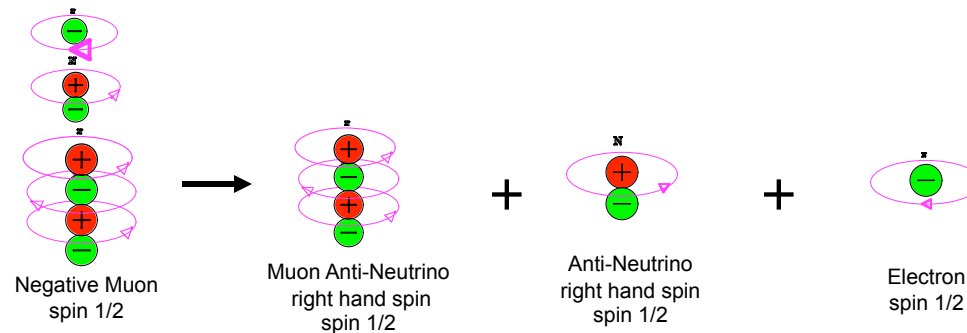
The charged pion decay was the hardest decay to figure out because it required that the two triplets of unit charge matter composing the up and down quarks within the core neutral pion phase from the three unit quarks into a substructure with an even number of units, so that the substructure of the decay product the muon neutrino would have zero rest mass. The answer was in the mathematics describing the neutral pion. The neutral pion core once created, resonates at  $(u\bar{u} + d\bar{d}) / (\text{square of } 2)$ .

Example: Negative Charged Pion

Core neutral pion resonating between  $u\bar{u}$  and  $d\bar{d}$  because the two triplet quarks are unstable as triplets.  
Needed an even number of units of matter to form neutral neutrinos.



The negative charged muon decay is then a straight forward weak force decay.



# Neutral Pion Spin and Decay - Unit Matter Substructures

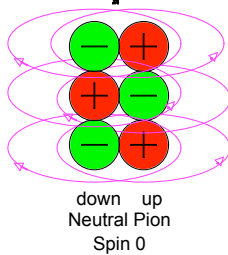
Physical Root Cause of Spin Zero Particles

What is the physical significance of spin zero particles? What is the meaning of zero spin considering a unit matter substructure?

Answer: Intrinsic angular momentum of zero means structurally that energy is in rotation in equal amounts in both directions. Bosons have substructures with no open electrical field lines of force.

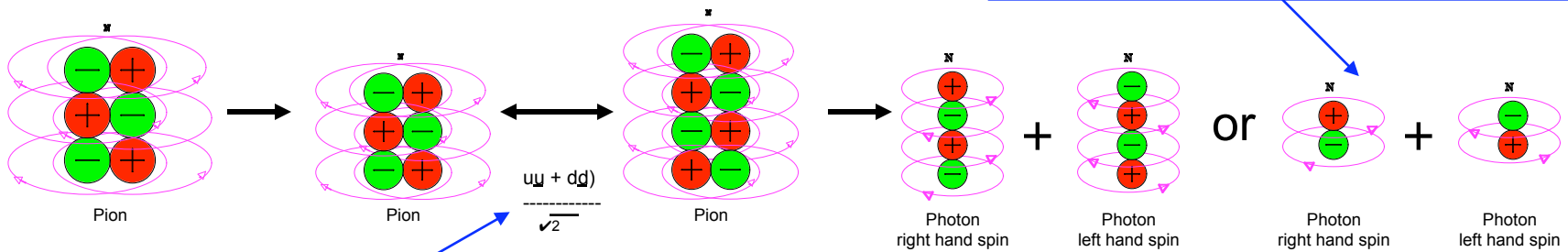
Bosons have an even number of units of matter in their root substructure with no open electrical field lines of force.

Bosons have an even number of sets of energy as the energy is paired in counter rotating pairs.



Spin zero means the internal substructure has an even number of counter rotating internally bound sets of energy. For neutral pions, the up quark contributing right hand spin and the down quark contributing left hand spin gives a total of zero.

## Example: Neutral Pion Decay

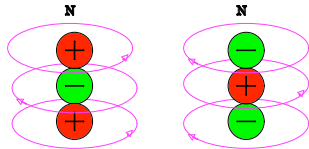


There is no point in the diagrams for photons representing more than a single doublet substructure. We represent all photons as a single doublet substructure.

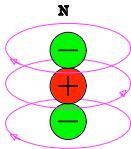
Following the mathematics, once the neutral pion is created, it resonates at  $(u\bar{u} + d\bar{d}) / (\text{square of } 2)$ .  
 If the pion had just been an up quark and a down quark instead of phasing through anti-up and anti-down, there would have been a problem.  
 I needed eight units of matter to have two even numbered unit matter substructures for the two resulting photons. The important point is the pion decays into two even numbered unit matter substructures of zero rest mass and the energy divides equally between the two substructures in the decay.

# Rules of Unit Electrical Matter Substructures

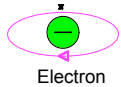
... the components being **electrically charged units of matter** and **units of energy**.



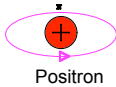
Up Quark



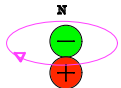
Down Quark



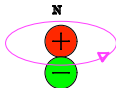
Electron



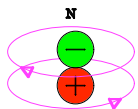
Positron



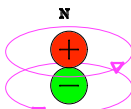
Neutrino



Anti-Neutrino



Photon Left



Photon Right

## Odd Numbered Energy Rotation Rule:

Odd numbered sets of energy rotation bound to unit matter substructures sum to a total intrinsic quantum angular momentum energy of  $1/2$ .

(Odd numbered sets of energy are bound to odd numbered unit matter substructures such as the triple unit matter substructures of quarks or the single unit matter substructures of electrons and positrons.)

## Odd Numbered Unit Matter Substructure Rules:

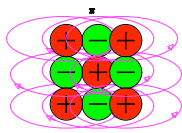
- Odd numbered unit matter substructures sum to a total of one free electrical field.
- Odd numbered unit matter substructures have rest mass-energy internal to the substructure.

## Even Numbered Energy Rotation Rule:

Even numbered sets of bound energy sum to a total intrinsic quantum angular momentum of 1. (Even numbered sets of energy are bound to even numbered unit matter substructures such as photons.)

## Even Numbered Unit Matter Substructure Rules:

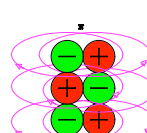
- Even numbered unit matter substructures sum to a total of zero free electrical fields.
- Even numbered unit matter substructures have no rest mass-energy internal to the substructure.



u d u  
Proton

Protons have quantum angular momentum  $1/2$  with each of 3 quarks contributing  $+/- 1/2$ .

Fermions have an odd number of units of matter in their root substructure with one set of open electrical field lines of force (charge  $+1$ ) and one net set of energy in rotation (spin  $1/2$ ).



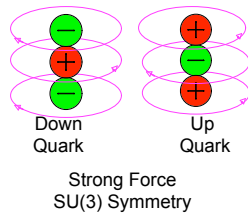
u d  
Pion

Pion spin zero is explained as each up and down quark with spin  $1/2$  which sums to give an intrinsic spin of zero with each contributing counter rotating energy set canceling.

Bosons have an even number of units of matter in their root substructure with zero sets of open electrical field lines of force (charge 0) and zero net sets of energy in rotation (spin 0).

# Explanation 1 The Origin of the Symmetry of the Natural Forces

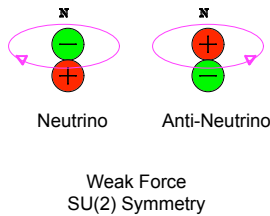
The origin of the symmetry exhibited by the natural forces.



## SU(3) Symmetry of Strong Force Interactions

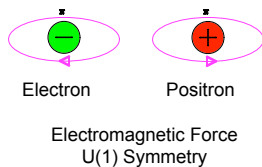
The SU(3) symmetry exhibited by quarks in strong force interactions originates due to the energy of the quark being configured in common rotation about 3 unit matter centers of rotation.

Energetic interactions between quarks is energetic interactions between triplet unit matter substructures, therefore the energy exchanged between quark triplets is configured about 3 points of charge. Energy exchanged between quarks exhibits SU(3) symmetry because that particle energy is in common complex rotation about about 3 points of charge in each of 3 quarks.



## SU(2) Symmetry of Weak Force Interactions

The SU(2) symmetry exhibited by neutrinos in weak force interactions originates due to the energy of the neutrino being configured in common rotation about 2 unit matter centers of rotation.



## U(1) Symmetry of Electromagnetic Force

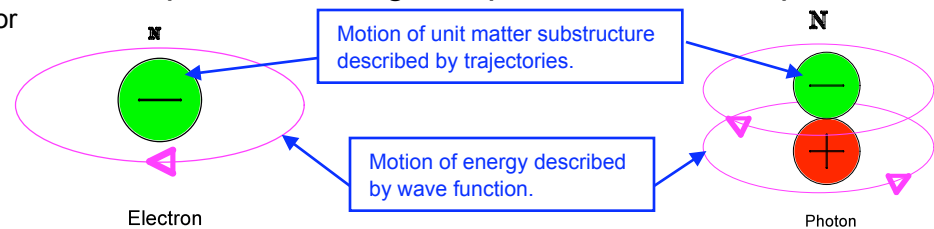
The U(1) symmetry exhibited by electromagnetic force originate due to the energetic interactions being configured about a single center of rotation.

## Explanation 2 The Origin of Wave-Particle Duality and the Two Slit Experiment

The unit of matter substructure contributes the particle behavior and the energy contributes the wave behavior.

Wave-particle duality is due to the Standard Model particles being composed of two components;

- units of matter which contribute the particle behavior
- units of energy which contribute the wave behavior



The rotation of energy about the center of charge is described exactly by the mathematics of the wave function. One must do exactly what the mathematics tells us to do.

How can energy rotate about an electron at an astounding ? Answer, it is energy in rotation not matter. Energy itself is not restricted to the speed of electromagnetic interactions. Electromagnetic interactions require moving a unit of matter, which is electric charge, which is an electromagnetic interaction. The model proposed has energy in rotation around the center of charge, so this is in no way similar to matter in rotation around another center of matter and not limited to the speed of light like unit matter substructure particles would be.

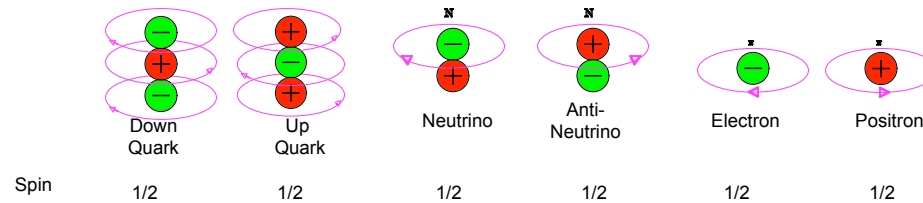
The mathematical description of energy rotation requires complex numbers because the phase of the energy must be accounted. Complex numbers is the mathematical space to track both phase and amplitude as must be done for the rotation of energy.

The two slit experiment shows the dual wave-particle nature of the electron.

The electron as a particle can only go through one slit or the other because the electrical unit matter center of charge can only physically go through one slit or the other. The energy of the electron as described by the wave function goes through both slits causing the electron to interfere with its own electric field after passing through the slit.



# Standard Model Particle Unit Electrical Matter Substructures



If neutrinos were doublets, it meant that the units of matter were permanent in nature and not destroyable, even in close proximity, negative unit to positive unit.

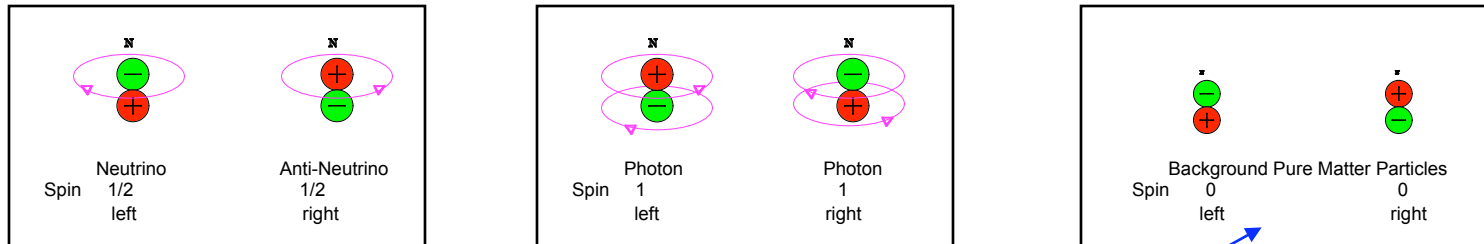
It followed that the doublet substructure had to have other manifestations other than energy bound in 1/2 quantum angular momentum like the speculated neutrino.

It was as if the units of matter follow the behavior of quarks under the strong force in which the force decreases asymptotically with distance.

Finally, it is obvious the difference is the strong force is when the electrical field interaction is governed by closed lines of force and electromagnetic force when the electrical field interaction is governed by open lines of force.



# Doublet Unit Electrical Matter Substructures



The subject of Part 2.



# The End of Part 1 Summary