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Proof of Concept for a Twin Prime Number Universe Using Set Theory

John R. Crary

Independent Researcher, Lake Zurich, IL, USA
Email: john.r.crary@gmail.com

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Abstract

The Fine Structure Constant (eFSC) Model attempts to give a classical definition to a magical number that underlies much of quantum physics. The Fine Structure Constant (α) value equal to 137.03599206 represents a dimensionless constant that characterizes the strength of the electromagnetic (EM) interaction between subatomic charged particles. Python-generated property counts for the twin prime force F\{139/137\} show that the adjusted ratio gives a value of α = 137.036. This implies a mathematical framework underlying this constant is based on twin prime numbers and set theory. This study attempts to demonstrate a proof of concept that a hierarchy of fractional twin prime (α_{II}) forces replicates the quantum nature of the universe and is aligned with the Standard Model of Particle Physics. An expanded eFSC Model demonstrates that twin prime forces and their property sets are mathematically viable substitutes for nuclear reactions, as demonstrated for the Beta-minus decay of neutrons into protons. Most significantly, the positive and negative prime numbers define these nuclear reactants and products as positive or negatively charged ions. Furthermore, the eFSC Model provides new insights regarding the hierarchy of EM forces underlying the quantum nature of the universe.

Keywords

Fine Structure Constant (α), Prime Numbers, Set Theory, Conceptual Model, Quantum Physics, Light and Matter, Beta-Minus Decay

1. Introduction

The syntax to describe the eFSC model is unique and warrants explanation. Previous papers [1]-[3] have used the notation "U\{Top Prime/Bottom Prime\}" to reflect that each twin prime pair is a layered microcosm of a larger quantum universe. The new syntax "F\{Top Prime/Bottom Prime\}" reflects the idea that each twin pair represents a separate and distinct force inside a universe of forces. Each force is associated with different property sets, identified by p{Top Prime/Bottom Prime} that encapsulate their quantum states as n-element sets of prime numbers.

The Fine Structure Constant (eFSC) theory is a still-evolving conceptual model that attempts to define the quantum nature of the universe based on classical prime number set theory. More specifically, it represents a mathematical model that attempts to align twin prime numbers to the electromagnetic (EM) forces underlying the standard model of particle physics.

The Fine Structure Constant (α) represents the electromagnetic interaction characterizing the strength of elementary charged particles, such as electrons and protons [4]. The dimensionless value (α) underlies Quantum Electrodynamics (QED) and Quantum Chromodynamics (QCD) theories, suggesting a hidden framework that makes this number fundamentally significant. The eFSC Model attempts to define that underlying framework using classical methods.

The eFSC Model began by calculating the property sets for the twin primes {139, 137}, where $\alpha = 139$ over $\alpha = 137$, and combining them to calculate the hybrid $\alpha = 137.036$ [1], closely replicating the observed α value of 137.035999206 [4]. Applying these same calculations to other sets of twin primes from {3, 2}, {5, 3}, through {199, 197} produces a hierarchy of twin prime electromagnetic (EM) forces that comprise the eFSC Model [2] [3].

For example, the twin primes {19, 17} produce the EM force F{19/17} = 17.600 with the p{19/17} enumerated property sets: "{19}, {2, 17}, {3, 5, 11}" and "{17}, {2, 3, 5, 7}". The p{Top Prime/Bottom Prime} label makes referencing the property counts for the higher twin sets plausible. For example, the number of p{139/137} property sets equals 1500 enumerated sets.

The whole number α values, such as 17.600 or 137.036, reflect the absolute EM forces and are typically not used in the eFSC Model. Instead, the model uses their fractional α_{II} values, such as 0.600 and 0.036, as a relative measure of EM strengths. The symbol α_{II} uses the subscript "II" to designate it as the twin fractional EM force.

Figure 1 illustrates a plot of fractional (α_{II}) EM forces distributed over the full range of twin prime pairs in this study.

The objective is to identify patterns that align the eFSC model with the established principles of the Standard Models of Physics [5] and Cosmology [6]. Using $\alpha_{137} = 0.036$ for light as a dividing line, the fractional EM forces (α_{II}) increase towards the left as the twin values decrease. Likewise, they decrease towards the right as the twin pairs get larger.

The electromagnetic (EM) region to the left of light represents the visible, baryonic matter-filled universe. In contrast, the EM region to the right represents the dark part of our universe, specifically dark matter and energy. The concept posits that the dark region has α_{II} EM values too low to interact with light as we know it. Therefore, we cannot see it except through its gravitational effects and as a possible source driving cosmic expansion.

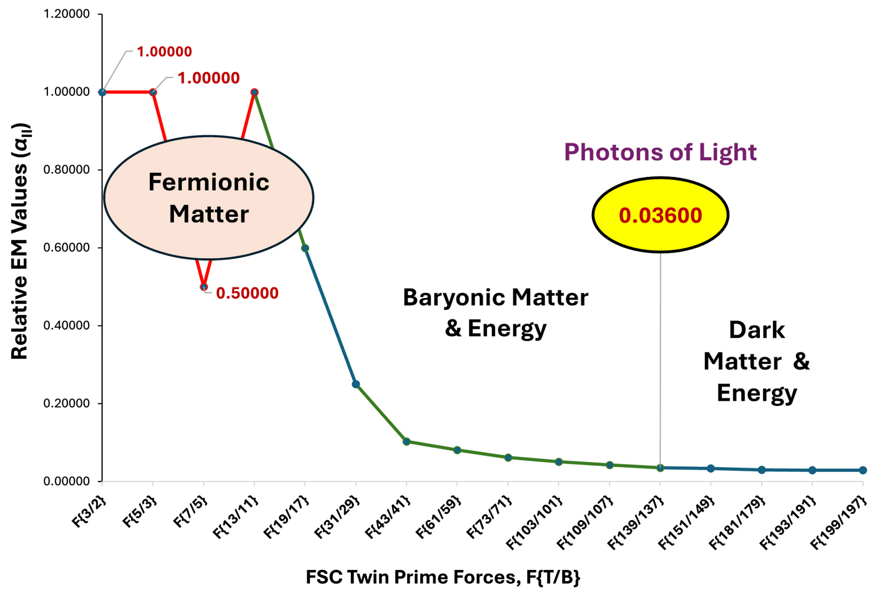

Figure 1. Plot of fractional twin prime forces.

Of particular significance are the three adjacent twin forces $F\{7/5\}$, $F\{5/3\}$, and $F\{3/2\}$ that combine to create the single entangled force $F\{7/5/3/2\}$, the strong force [7], which powers the ability of gluons to bind quarks together. Encapsulated within $F\{7/5/3/2\}$ are the $p\{7/5\}$, $p\{5/3\}$, and $p\{3/2\}$ property sets that endow quarks with their "color charge", a fundamental aspect of their SM particle nature, and the interactions mediated by the weak force.

This qualitative study is not intended to undermine any of the physics described in the Standard Model but rather to provide a classical interpretation of empirical sciences based on prime numbers and set theory. The process is analogous to developing computer data models: identifying relevant data, structuring it into relational entities, connecting them into logical relationships, and then analyzing the information to resolve critical questions.

The eFSC Model is still evolving, meaning that what is considered correct today may change tomorrow as our understanding of its correlation with known physics improves. This thesis does not claim a deep comprehension of quantum physics; instead, it focuses on basic physics and chemistry sufficient to develop the logic connecting them in a classical theory. The intent is to look at the universe through the lens of logic and set theory rather than an amalgam of just scientific knowledge with its complex mathematics.

This paper utilized an AI assistant, specifically an author-developed ChatGPT-4o language model [8], to aid in developing the eFSC theory and establishing correlations with the underlying physics.

2. Methodology

The eFSC conceptual model development was driven by the Fine Structure Constant, α = 137.035999206, a dimensionless value appearing in many physics areas. It is fine-tuned to allow atoms to exist, determine the fine structure of atomic spectra, and govern the electromagnetic interactions between elementary charged particles. It also has implications for the cosmological evolution of the universe.

Great physicists like Richard Feynman, Paul Dirac, Wolfgang Pauli, and many others have expressed dismay that no underlying explanation exists for this constant and why this exact number can only be measured.

This investigation began by observing that the value of α (~137.036) began with the whole number 137, a primary twin number with 139. This observation led to the possibility that perhaps the prime numbers, which are only divisible by 1 and themselves, are stable compared to the composite numbers, and offer a logical framework for stable matter that mimics the observable universe.

An assumption was developed on the predicate that the real number value for α equal to ~137.036 is a product of two separate "microverses" where α = 137 and α = 139, best described in reference [1] and illustrated in Figure 2.

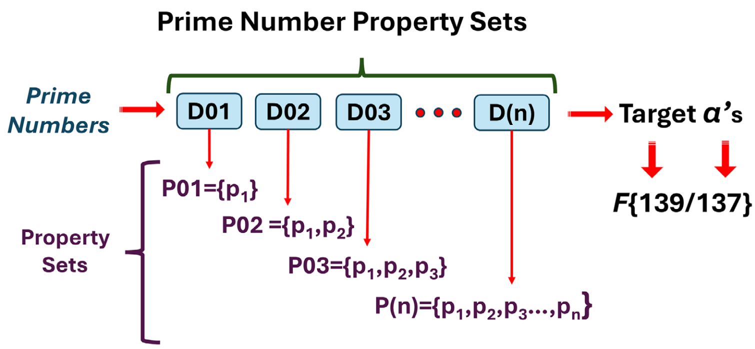

Figure 2. eFSC dimensional property counts.

A Python algorithm was developed to calculate property sets for α = 137 and α = 139, where the sum of the elements, all prime numbers, equals their 137 or 139, respectively. The count of property sets (#139 & #137) was then used to calculate a hybrid value of F\{139/137\} where α = 137.036, using the expression:

$$\alpha = 137 + \left(\left(\#139+1\right)-\left(\#137-1\right)\right)/\left(\#139+\#137\right) = 137.036$$

The reason for the adjusted counts (#139 + 1) and (#139 − 1) is due to the hybrid nature of twin prime forces where the p\{137\} property sets is a outgrowth of its p\{139\} parent.

The important thing to understand is that this α calculation is not limited to F\{139/137\} but can be applied to all the twin prime combinations above and below. What this achieves is a conversion of the α value into discrete property sets that better reflect its quantum nature. No experimental evidence supports these assumptions, except that its math replicates the value of α. All subsequent work on the eFSC Model has been to determine how these eFSC forces and property sets relate to our understanding of physics and cosmology.

The eFSC Model is limited because it can only determine EM forces and quantum energy wells for particles and waves, not momentum, kinetic energy, or other unit-based physical constants.

3. Electromagnetic Force for Light

The fundamental concept behind the eFSC theory is to develop a mathematical explanation for the Fine Structure Constant (α) using prime numbers and set theory. A Python algorithm was employed to calculate n-element property sets for the twin primes {139, 137}, the ratio of which is used to calculate the fractional F\{139/137\} EM force (α_{II}) for light.

The α_{137} calculations use the F\{139/137\} property counts p\{139\} and p\{137\}, as shown in Equation (1),

$$\begin{aligned} &\alpha = 137 + \alpha_{\text{II}} = 137.036 \\ &\text{where } \alpha_{II} = \left(\left(p\{139\}+1\right)-\left(p\{137\}-1\right)\right) \Big/ \left(p\{139\}+p\{137\}\right) = 0.036 \end{aligned} \tag{1}$$

This represents a difference over Sum (DoS) calculation where α_{II} = (A − B)/(A + B) using the hybridized property counts (p\{139\} + 1) for A and (p\{137\} − 1) for B.

The cumulative property counts p\{139\} and p\{137\} for F\{139/137\} are shown in Figure 3.

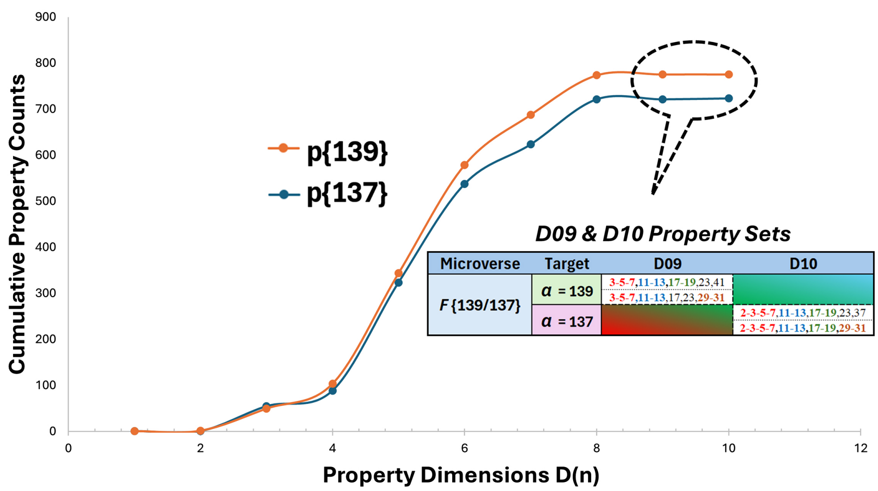

Figure 3. Cumulative F\{139/137\} property counts.

The counts for p\{139\} and p\{137\} are shown separately to illustrate how they change as the property sets increase from 1 to 10 elements. The higher number twin, p\{139\}, generates more property sets than the lower twin, p\{137\}, which is almost always the case except for the lowest twin pairs.

The F\{139/137\} force represents a massless mechanism for the transportation of electromagnetic energy across space and time, facilitating a baryonic-to-baryonic connection in our universe. This raises the question of how a single positive F\{139/137\} force can generate waveforms of light that exhibit both positive and negative charges.

This is where it is important to understand that the eFSC model force F\{139/137\} and its property sets p\{139/137\} do not encapsulate the entire electromagnetic waveform, which is comprised of an electric field, magnetic field, and implied momentum. It only represents the electric charge potential at zero rest mass, essentially a standing wave without momentum.

Therefore, the $F\{139/137\}$ charge needs to be balanced with an equal and opposite $F\{-139/-137\}$ charge with the understanding that when it acquires momentum (energy), it creates its own oscillating waveform moving at the speed of light (c).

The calculations for an equal but opposite negative $F\{-139/-137\}$ force are shown in Equation (2).

$$\begin{aligned} -\alpha &= -137 - \alpha_{\text{II}} = -137.036 \\ \text{where } -\alpha_{\text{II}} &= \big(\left(p\{-137\} - 1 \right) - \left(p\{-139\} + 1 \right) \big) \big/ \left(p\{-139\} + p\{-137\} \right) \\ &= -0.036 \end{aligned} \tag{2}$$

This represents a difference over Sum (DoS) calculation where $-\alpha_{\text{II}}$ = (B − A)/(A + B) using the hybridized property counts ($p\{-139\} - 1$) for A and ($p\{-137\} + 1$) for B.

Instead of the lopsided force $F\{139/137\}$ creating electromagnetic radiation, it is much more feasible that both $F\{139\}$ and $F\{-139/-137\}$ forces act as a single $F\{\pm139/\pm137\}$ force to define charge oscillations. This gives photons of light Charge Symmetry, an important concept involving CPT symmetry for the Standard Model.

4. Nuclear Forces

The eFSC Model combines the twin prime forces $F\{7/5\}$, $F\{5/3\}$, and $F\{3/2\}$ into a single strong force $F\{7, 5, 3, 2\}$. This composite force describes fundamental particles like protons, neutrons, and first-generation quarks and leptons.

Table 1 compares the Standard Model definitions for protons to the eFSC Model definitions.

Table 1. Original eFSC model vs. the standard model.

eFSC Definition of Protons						
Standard Model (SM)			Fine Structure Model (FSC)			
SM Particle	Charge	Force	α_{II} Forces	Charges*	α_{II} Particles	FSC Sets
Down (d) Quark	-1/3	Gluons	$F\{7/5\}$	+1/3	$p\{7/5\}$	{7} & {5,2} {5} & {3/2}
Up (u) Quark	+2/3	Gluons	$F\{5/3\}$	+2/3	$p\{5/3\}$	{5} & {3/2} {5} & {}
Up (u) Quark	+2/3	Gluons	$F\{3/2\}$	+2/3	$p\{3/2\}$	{3} & {} {2} & {}

* The eFSC EM quark charges of [+0.5, +1.0, +1.0] are normalized to the same scale as the SM Charges.

This table is divided into two sections: the Standard Model on the left and the eFSC Model on the right. The Standard Model describes the type of particles, in this case, down and up quarks, the charge of each quark, and the color-coded strong force (gluons) holding the quarks together.

The eFSC Model shows the twin prime α_{II} forces (gluons) binding the eFSC quarks together, their normalized charge ratio, the α_{II} particles that define quarks, and the enumerated property sets defining them.

The Standard Model describes a proton as having one down (d) quark with a charge of −1/3 and two up (u) quarks, each with a charge of +2/3, giving the proton a net charge of +1. Gluons mediate the strong nuclear force that binds the quarks together. In the eFSC Model, the corresponding quark-like particles are defined by the property labels *p*{7/5}, *p*{5/3}, and *p*{3/2}.

The highlighted sections of the eFSC Model in Table 1 indicate areas where it is functionally incorrect or incomplete. Firstly, the Standard Model assigns Down (d) Quarks a charge of −1/3, whereas the eFSC Model calculates the down quark, *p*{7/5}, highlighted in orange, to have a charge of +1/3. Secondly, the *p*{5/3} and *p*{3/2} property sets that define quarks, highlighted in green, appear to have missing sets, assuming that all their property sets should have the same enumerated property counts. To better understand these issues, we need to apply established physics, specifically examining the weak nuclear force that governs the decay of a neutron into a proton.

The general process of Beta-minus Decay is illustrated in Reaction (3).

$$\text{Neutron}(\text{d},\text{d},\text{u}) \to \text{Proton}(\text{d},\text{u},\text{u}) + \text{Electron}\left(\text{e}^-\right) + \text{Antineutrino}\left(\nu^-\text{e}\right) \quad (3)$$

This reaction demonstrates how a neutron decays into a proton, an electron, and an antineutrino, a well-established phenomenon in particle physics.

We can simplify this reaction further because Beta-minus Decay only involves the conversion of a single down (d) quark into a single up (u) quark with a W⁻ boson intermediate, as shown in Reaction (4).

$$\begin{aligned} &\text{Down Quark}(-\text{d}) \to \text{Up Quark}(+\text{u}) + \text{Boson}\left(\text{W}^-\right) \\ &\to \text{Up Quark}(+\text{u}) + \text{electron}\left(\text{e}^-\right) + \text{antineutrino}\left(\nu^-\text{e}\right) \end{aligned} \quad (4)$$

The first step in this reaction involves converting a down quark into an up quark and a W^- boson, which is followed by the W^- boson quickly decaying into an electron and an antineutrino.

Reaction 5 below replaces the Standard Model (SM) quarks and other particles with their eFSC model definitions (Property Sets) using standard mathematical substitutions by replacing the Down Quark with the *p*{−7/−5} property, the Up Quark with the *p*{5/3} property set, then balancing the integer properties for the W^- Boson, electron, and antineutrino. This illustrates how the eFSC model describes the Beta-minus Decay of neutrons into protons.

$$\begin{aligned} &p\{-7/-5\}(-\text{d}) \to p\{5/3\}(+\text{u}) + \{-2,-2\}\left(\text{W}^-\right) \\ &\to p\{5/3\}(+\text{u}) + p\{-2,-1\}\left(\text{e}^-\right) + p\{-1\}\left(\nu^-\text{e}\right) \end{aligned} \quad (5)$$

First, the (d) down quark is replaced by *p*{−7/−5} particle, and the (u) up quark is replaced by *p*{5/3} particle. The difference between the *p*{−7/−5} and *p*{5/3} quarks produce the {−2, −2} W-boson. The {−2, −2} property, not aligned with any existing eFSC force, quickly decays into a *p*{−2/−1} electron with a yet undefined *F*{−2/−1} force. All with maintaining the Charge Symmetry described in the previous section, "Electromagnetic Force for Light," where positive {Top/Bottom} charges are balanced by their {−Top/−Bottom} negative charges.

With this new understanding, the eFSC model requires an upgrade to better define the role of the *F*{−2/−1} force to define electrons and antineutrinos and is described in the next section.

5. Expanded eFSC Model

The upgraded eFSC Model, including the newly identified $F\{-2/-1\}$ force to define electrons, is illustrated in Table 2.

Table 2. Expanded eFSC model vs. the standard model.

eFSC Definition of Protons and Electrons						
Standard Model (SM)			Fine Structure Model (eFSC)			
SM Particle	Charge	Force	αII Forces	Charges*	αII Particles	FSC Sets
Down (d) Quark	-1/3	Gluons	*F*{-7/-5}	-1/3	*p*{-7/-5}	{7} & {5,2} {5} & {3,2}
Up (u) Quark	+2/3	Gluons	*F*{5/3}	+2/3	*p*{5/3}	{5} & {3,2} {3} & {2,1}
Up (u) Quark	+2/3	Gluons	*F*{3/2}	+2/3	*p*{3/2}	{3} & {2,1} {2} & {1,1}
Electron(e-)	-1	EMF	*F*{-2/-1}	-1	*p*{-2/-1}	{-2} & {-1,-1} {-1} & {}

* The eFSC EM quark charges of [+0.5, +1.0, +1.0] are normalized to the same scale as the SM Charges.

The eFSC model changes the positive $F\{7/5\}$ force to a negative $F\{-7/-5\}$ force, converting the eFSC down quark $p\{7/5\}$ with a charge of +1/3 to an eFSC down quark $p\{-7/-5\}$ with a charge of −1/3, highlighted in orange. This replicates the down quark charge as defined by the Standard Model.

The eFSC model now includes a negative $F\{-2/-1\}$ force and associated $p\{-2/-1\}$ properties (green) that describe negatively charged electrons and neutral antineutrinos. The antineutrino, not shown, represents the lowest possible property $p\{-1\}$ or simply $\{-1\}$ for any eFSC property sets, indicating that it is the most functionally restricted.

The eFSC model now aligns the positive charges of cations with the set of positive integers and the negative charges of anions with negative integers. This includes the negative and positive twin prime forces and the non-prime integers −1 and 1. If correct, the eFSC model suggests that positive Matter (+) and negative Matter (−) divide the visible universe into separate positive (cation) and negative (anion) domains.

An additional example that aligns the eFSC model with the Standard Model is that it predicts the single beta decay of neutrons into protons and the rare Double Beta Decay (DBD) of neutrons into protons. Replacing the target up quark $p\{5/3\}$ (u) in reaction 5 with the $p\{3/2\}$ down quark (u) replicates the intermediate DBD reaction step shown in Reaction (6).

$$p\{-7/-5\}(\mathrm{d}) \rightarrow p\{3/2\}(\mathrm{u}) + 2\cdot\{-2,-2\}\left(\mathrm{W}^{-}\right) \quad (6)$$

This substitution of eFSC definitions into actual nuclear or subatomic reactions represents the model's ability to extrapolate real-world associations and dependencies.

Lastly, the quark particles $p\{-7/-5\}$, $p\{5/3\}$, and $p\{3/2\}$, with charges −1/3, +2/3, and +2/3, representing quarks held together by gluons without requiring a color charge to define them. The gluons now have identities and do not require color charges to differentiate them. This is best illustrated using the simplified expression:

$$F\{-7/-5\} \leftrightarrow F\{5/3\} \leftrightarrow F\{3/2\}$$

How the eFSC model might describe the strong nuclear force in detail is yet to be determined.

6. Twin Prime Symmetry

The updated eFSC model demonstrates the alignment of positive charge cations with the set of positive integers and negative charge anions with the set of negative integers. This framework allows for a more systematic and potentially insightful analysis of how charged particles are inherently connected to real-world mathematics.

This understanding, along with the Charge-Symmetry described for the $F\{\pm139/\pm137\}$ that generates electromagnetic radiation, provides a novel perspective for how ionic charges are also aligned with positive and negative twin prime forces.

Figure 4 illustrates positive and negative charges as mirror images.

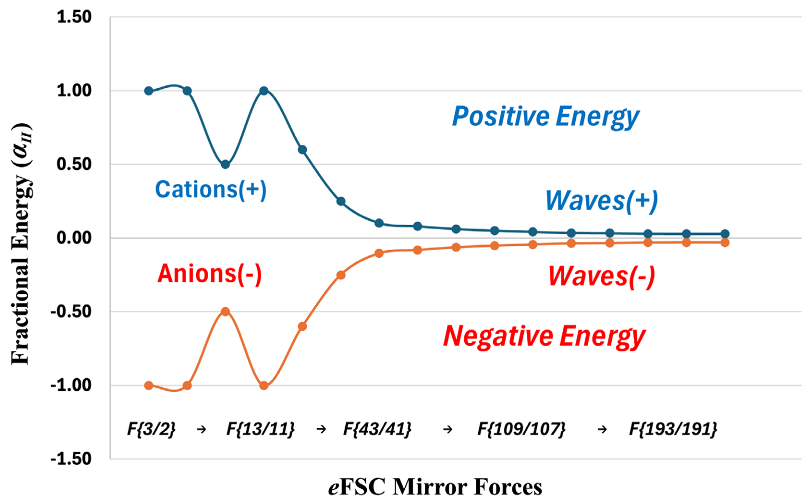

Figure 4. Positive/Negative charge symmetry.

The concept is that positively charged ions (+), can only be created by positive EM forces and properties. In contrast, negatively charged particles (−) are created from negative EM forces and their negative property sets.

The higher twin primes with lower EM forces produce positive/negative energy waves. In contrast, the high EM forces for $F\{7/5/3/2\}$ create positive or negative charged particles we observe as cations and anions. The most striking aspect of the strong $F\{7/5/3/2\}$ force is that it produces functionally stable ions and matter. Everything else, including dark matter as an extreme case, represents something else.

The question remains as to why the universe favors matter over antimatter, or as the eFSC Model describes it, why there are positively charged protons and electrons rather than negatively charged antiprotons and positrons. The eFSC Model still considers the asymmetric universe an enigma but may offer additional clues as to why.

7. Atomic Orbitals

For the eFSC theory to be a fully viable representation of quantum reality, it must also be able to model atomic orbital theory. Not so much the complex quantum mechanical calculus but more so the hierarchical structure of atomic orbitals defined by the Principal Quantum Number (n) of Quantum mechanics.

The basic energy levels for a single eFSC orbital shell are illustrated in Figure 5.

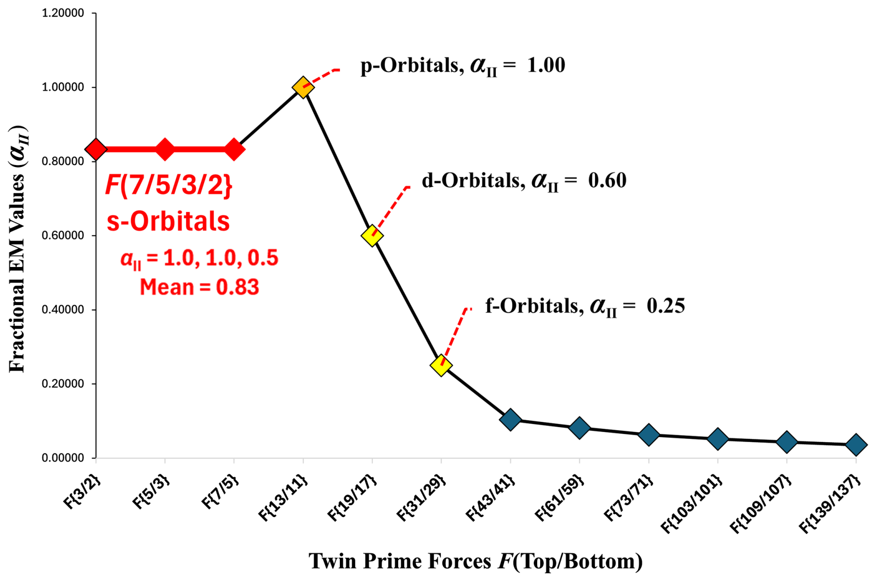

Figure 5. eFSC shell orbital EM forces.

The premise is that each set of s-, p-, d-, and f-orbital shells are identified by their principal quantum numbers (n), as described below:

1) F{7/5/3/2} → s-orbitals for $n \geq 1$, where the average α_{II} ~ 8.33:

- Here, the forces F{−7/−5}, F{5/3}, F{3/2} correspond to individual α_{II} values −0.5, 1.0, and 1.0, respectively.

2) (1) + F{13/11} → p-orbitals for $n \geq 2$, where α_{II} = 1.0:

- This means that adding the force F{13/11} to the s-orbitals gives rise to the p-orbitals starting at $n = 2$.

3) (2) + F{19/17} → d-orbitals for $n \geq 3$, where α_{II} = 0.6:

- Adding the force F{19/17} to the p-orbitals results in the d-orbitals, which begin at $n = 3$.

4) (3) + F{31/29} → f-orbitals for $n \geq 4$, where α_{II} = 0.25:

- Further adding the force F{31/29} to the d-orbitals leads to the f-orbitals, starting at $n = 4$.

Table 3 further elaborates on this eFSC concept, showing all possible shells, including those not associated with orbiting electrons, and how they align with the Standard Model's definition of orbitals.

Table 3. eFSC model vs standard model atomic orbitals.

n	Light	Non-Orbital Twin Prime Forces					f-Orb	d-Orb	p-Orb	s-Orb
10	*F*{139/137}	*F*{109/107}	*F*{103/101}	*F*{73/71}	*F*{61/59}	*F*{43/41}	*F*{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}
9	→	*F*{109/107}	*F*{103/101}	*F*{73/71}	*F*{61/59}	*F*{43/41}	*F*{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}
8	$8s^2$	→	*F*{103/101}	*F*{73/71}	*F*{61/59}	*F*{43/41}	*F*{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}
7	$7p^6$	$7s^2$	→	*F*{73/71}	*F*{61/59}	*F*{43/41}	*F*{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}
6	$6d^{10}$	$6p^6$	$6s^2$	→	*F*{61/59}	*F*{43/41}	*F*{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}
5	$5f^{14}$	$5d^{10}$	$5p^6$	$5s^2$	→	*F*{43/41}	*F*{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}
4		$4f^{14}$	$4d^{10}$	$4p^6$	$4s^2$	→	*F*{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}
3				$3d^{10}$	$3p^6$	$3s^2$	→	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}
2		***Atomic Orbitals***				$2p^6$	$2s^2$	→	*F*{13/11}	*F*{7/5/3/2}
1								$1s^2$	→	*F*{7/5/3/2}

The Standard Model hierarchy of atomic orbitals is highlighted in green in relation to their principal quantum numbers for $n \geq 1$. These s-, p-, d-, and f-orbital layers form our basic understanding of how electrons fill multiple energy levels, starting at $n = 1$ and ending around $n = 7$ for the largest atoms.

The equivalent pattern for eFSC orbitals is highlighted in yellow to the right. This shows a direct one-to-one correspondence between the Standard Model orbital hierarchy and the eFSC orbital hierarchy. This is a good indication that they describe the same underlying framework.

However, the eFSC model is based on mathematical sets of prime numbers, so its energy shells do not stop with the orbitals. These non-orbital shells, shown in white, comprise additional baryonic forces that define observable matter and energy, even more so considering that a large portion of the atomic orbital shells is usually unoccupied.

Although it is questionable whether these shell states can be virtually defined, the idea appears mathematically sound. However, it seems unreasonable to think these forces come and go as virtual energy points but are ever present as energized standing wave remnants of the Big Bang.

Lastly, the eFSC shell hierarchy continues above what is shown in **Table 3**, including dark matter, which has α_{II} forces too low to absorb or emit electromagnetic radiation. We should not ignore dark matter because it represents 85% of the matter in the universe. The most interesting thing is whether the eFSC Model can help us understand if and how matter and dark matter exchange energy. Current theories include dark photons, dark matter decay, gravity, and hypothetical particles, to which the eFSC Model may give some additional insight. It's all speculation, but it makes for interesting thought experiments.

8. Conclusions

The eFSC Model is a conceptual theory derived from twin prime number calculations that match the observed value of the Fine Structure Constant, where α is 137.036, an absolute measure of the electromagnetic (EM) force for light. The eFSC theory posits that the fractional part of $\alpha = 0.036$ is a more accurate measure of the relative EM strength. These fractional α_{II} forces were calculated for all twin prime sets for *F*{199/197} and below, producing a hierarchy of EM forces and property sets that define the eFSC universe.

The eFSC Model divides the fractional twin forces into two separate functional domains: baryonic matter from $F\{7/5/3/2\}$ to $F\{139/137\}$ having α_{II} values greater than or equal to 0.036, and the dark matter forces $F\{151/149\}$ up to $F\{199/197\}$, and higher, having α_{II} values lower than 0.036. This gives us a plausible explanation for why we can observe and measure matter but not dark matter.

This proof focuses on the twin forces $F\{-7/-5\}$, $F\{5/3\}$, and $F\{3/2\}$, which combine to form a single $F\{7/5/3/2\}$ force that binds quarks into protons. The eFSC proof of concept is demonstrated by substituting the $F\{7/5/3/2\}$ properties $p\{-7/-5\}$, $p\{5/3\}$, and $p\{3/2\}$ to describe a nuclear reaction for Beta-minus Decay, where neutrons decay into protons, electrons, and antineutrinos.

Reaction substitution and execution involve:

- Replacing the down quark (d) with the eFSC $p\{-7/-5\}$ particle.
- Replacing the up quark (u) with the eFSC $p\{5/3\}$ particle.
- Producing the intermediate reaction products: $p\{-7/-5\}(\mathrm{d}) \rightarrow p\{5/3\}(\mathrm{u}) + \{-2, -2\}(\mathrm{W}^-)$, which alters the quark charge from −1/3 to +2/3 and creating a (W^-) boson that balances the charge difference.
- The (W^-) boson, not aligned with any eFSC force, quickly decays to an electron and antineutrino, preserving the charge and the integer balance.

The eFSC Model parallels and complements the Standard Model of Particle Physics, replicating the Beta-minus Decay reaction and aligning it with the set of positive and negative integers that determines ionic charges. Although not comprehensive, the fact that eFSC theory aligns the set of positive integers with positive charges (cations) and the set of negative integers with negatively charged anions may provide profound insights into the nature of static charge assignments and electromagnetism.

Another analysis involves aligning eFSC atomic orbitals to the s-, p-, d-, and f-orbitals systems described in the Standard Model and producing a one-to-one correlation between principal quantum numbers (n) and their respective orbital shells.

The eFSC Model provides a novel perspective on the electromagnetic forces underlying our quantum universe and perhaps another tool for understanding matter, dark matter, dark energy, and the asymmetric nature of matter and antimatter.

Whether this represents a definitive proof of concept for the Fine Structure Constant (eFSC) theory is debatable. Still, it certainly adds to the mounting evidence that the eFSC Model reflects much of the structure and functionality of the Standard Model. What comes next is to determine if the eFSC Model has the capability to calculate particle masses and associated energy.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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