Scientific Research Publishing

American Journal of Computational Mathematics, 2025, 15(2), 174-190
https://www.scirp.org/journal/ajcm
ISSN Online: 2161-1211
ISSN Print: 2161-1203

The Conceptual Framework for a Fine-Structure (α) Prime Number-Based Universe

John R. Crary

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

How to cite this paper: Crary, J.R. (2025) The Conceptual Framework for a Fine-Structure (α) Prime Number-Based Universe. *American Journal of Computational Mathematics*, **15**, 174-190.
https://doi.org/10.4236/ajcm.2025.152009

Received: May 3, 2025
Accepted: June 9, 2025
Published: June 12, 2025

Abstract

This paper presents the development of a conceptual model of the universe, grounded in the Fine Structure Constant ($\alpha \approx 137.036$). The Extended Fine Structure Constant (eFSC) Model explores α as a function of twin prime microverses (U{137}, where $\alpha = 137$, and U{139}, where $\alpha = 139$), each defined by n-dimensional sets of prime numbers. Property counts for U{137} and U{139} are used in a modified Difference over Sum (DoS) calculation to approximate the fractional component of α, yielding a Relative Electromagnetic Force (EMF) value of $\alpha_{II} = 0.036$. Applying this method to additional twin prime pairs produces a distribution of EMF values that reflect the energy profiles of known Standard Model forces, identifying the strong force as a triad of overlapping EM interactions, and linking the weak force to particle transitions involving neutrons, protons, electrons, and neutrinos. The model provides a conceptual framework for investigating the Higgs mechanism, quantum orbital structures, quantum entanglement, and potential explanations for gravity, dark matter, dark energy, and time dilation. While not intended to supplant any existing physics, the eFSC Model offers a novel, prime-number-based architecture for interpreting the quantum universe through a classical lens.

Keywords

Structured Mathematical Universe, Fine Structure Constant (α), Quantum Time Structure, Ontological Physics, Conceptual Model

1. Introduction

The eFSC Model investigation began by questioning why the observed absolute value of the Fine Structure Constant (α) = 137.035999206 starts with the prime number 137. This investigation was initiated using a Python program to determine if this is a random circumstance or if there is a mathematical connection between prime numbers and quantum reality [1]-[4].

The hypothesis is that prime numbers exhibit an inherent mathematical stability amid the vast sea of integers, unlike composite numbers divisible by factors other than one and themselves. This analogy might support the strategy of using prime number mathematics as a foundational framework for modeling the quantum nature of the universe. While this analogy does not establish a causal link to physical reality, it may offer a useful heuristic for modeling foundational quantum structures. By treating prime numbers as discrete, stable units within a broader numerical field, the model explores whether this mathematical purity can parallel the quantized nature of particles and forces in the universe.

In this context, the twin prime values $\alpha = 137$ and $\alpha = 139$ are hypothesized to generate structured property sets of prime number elements defining quantum focal energy points for $\alpha = 137.036$.

A Python algorithm was developed to determine D(n) sets of elements for a twin U{139/137} microverse to investigate any underlying relationship between U{139} and U{137}. This algorithm is illustrated in Figure 1.

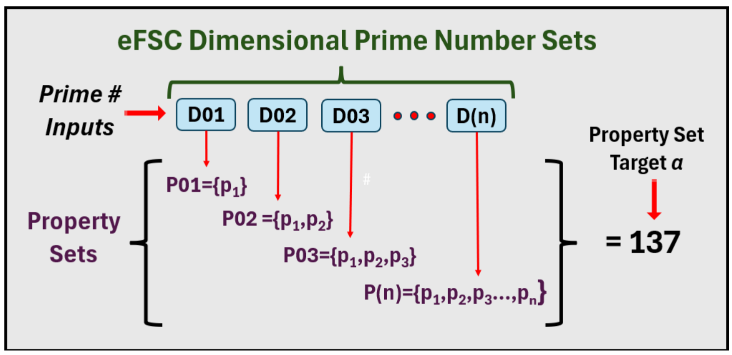

Figure 1. eFSC prime property calculations.

The property sets are constrained only to include unique prime numbers. Allowing duplicate values significantly distorts the results for the larger prime numbers, making them more exponential in their count growth characteristics.

Each prime number calculation is executed by generating property sets across dimensional levels, D(01) through D(n), where n = number of elements, and continuing until no additional valid sets can be produced. For instance, for $\alpha = 137$, the process terminated at D(10) with 724 unique property sets; for $\alpha = 139$, it concluded at D(09) with 776 sets.

The distribution of property sets for U{139/137} is shown in Figure 2, along with a single property count adjustment to account for property bleed between U{139} and U{137}.

The key point to understand is that a single property bleed from 139 D(02) into the 137-property set is necessary to make the DoS relative force calculations work, replacing the 137 D(01) property set, as shown below:

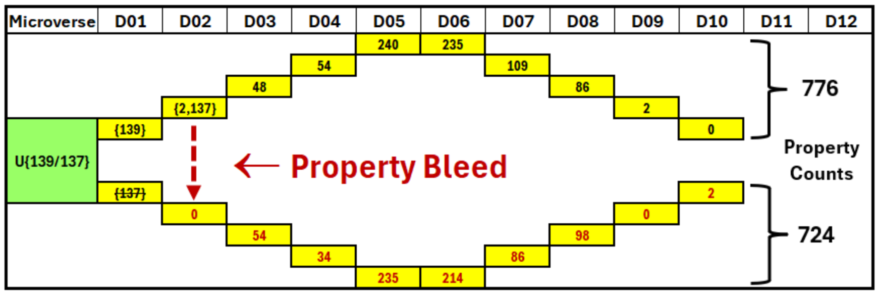

Figure 2. U{139/137} twin prime count distribution.

Property Bleed Calculations

- (776 + 1) represents the U{139} property count, plus a single property bled into U{137}.
- (724-1) represents the U{137} property count, minus the original D(01) property {137} which is now sourced from U{139}.

The F{139/137} calculation in Equation (1) gives fractional α_{II} or $\alpha_{137} = 0.036$, which, when combined with the based twin prime number 137, gives an absolute value of $\alpha = 137.036$.

$$\alpha_{137} = ((776 + 1) - (724 - 1))/(776 + 724) = 0.036 \quad (1)$$

Property bleed is critical to the eFSC Model because it dictates that the F{139/137} fractional force α_{II} is a hybrid of the individual U{139} & U{137} microverses, now represented as U{139/137}.

This combines the twin prime microverses into a single fractional α_{II} force and the property sets that define it. These twin forces and property sets are described below:

U{High/Low} → F{High/Low} + P{High/Low}

- **U{High/Low}** represents the prime number configuration for any twin prime microverse, for example: U{139/137}, U{139} over U{137}).
- **F{High/Low}** is the relative EMF force created by U{High/Low} microverse, Example: F{139/137} for the EM α_{II} force for light.
- **P{High/Low}** represents the set and/or count of properties that define each microverse, for example, P{139} = 776 sets, P{137} = 724 sets, and P{139/137} equals 776 + 724 = 1500 sets.

Applying this same calculation to all other twin prime microverses starting at U{3/2} up to U{199/197} produces a range of twin prime fractional forces α_{II} that present a classical distribution of EM forces and property sets that describe the eFSC universe. This permits a detailed inspection of the quantum world using classical analytical methods, specifically set theory against the underlying logic of the Standard Model.

The eFSC model uses relative EMF values, such as $\alpha_{137} = 0.036$, to model these twin prime forces and property relationships rather than the absolute α values. The fractional α_{II} values provide an ideal measure of relative EM strengths for the measured property counts for F{3/2} through F{199/197}.

The distribution of relative fractional α_{II} forces and property sets is shown in Figure 3.

Forces	Twin Sets	D01	D02	D03	D04	D05	D06	D07	D08	D09	D10	D11	D12	α_{Π}
F(199/197)	{199}	1	1	86	92	888	896	1177	1090	182	135	1		0.02906
	{197}	1		92	57	896	794	1090	1070	135	158		1	
F(193/191)	{193}	1	1	84	89	798	803	967	898	126	96			0.02930
	{191}	1		89	58	803	712	898	876	96	112			
F(181/179)	{181}	1	1	74	79	634	635	643	587	62	45			0.03021
	{179}	1		79	55	635	570	587	576	45	53			
F(151/149)	{151}	1	1	55	60	331	322	192	164	7	3			0.03364
	{149}	1		60	43	322	296	164	170	3	5			
F(139/137)	{139}	1	1	48	54	240	235	109	86	2				0.03600
	{137}	1		54	34	235	214	86	98		2			
F(109/107)	{109}	1	1	32	37	92	88	17	10					0.04299
	{107}	1		37	23	88	83	10	15					
F(103/101)	{103}	1	1	31	32	75	68	10	6					0.05140
	{101}	1		32	21	68	66	6	10					
F(73/71)	{73}	1	1	17	18	16	14							0.06250
	{71}	1		18	13	14	15							
F(61/59)	{61}	1	1	13	13	6	5							0.08108
	{59}	1		13	10	5	6							
F(43/41)	{43}	1	1	6	6	1								0.10345
	{41}	1		6	6		1							
F(31/29)	{31}	1	1	4	3									0.25000
	{29}	1		3	3									
F(19/17)	{19}	1	1	1										0.60000
	{17}	1			1									
F(13/11)	{13}	1	1											11.00000
	{11}	1												
F(7/5)	{7}	1	1											0.50000
	{5}	1	1											
F(5/3)	{5}	1	1											1.00000
	{3}	1												
F(3/2)	{3}	1												1.00000
	{2}	1												

Figure 3. All twin prime property counts.

These properties represent dimensional focal energy points with no time, distance, or momentum; they are quantized energy wells with implied functionality.

This table is color-coded to highlight how the eFSC Model categorizes and describes the wave-particle nature defined by the Standard Model.

- Purple rows represent the EMF forces associated with neutrons and protons, from which the eFSC Model predicts electrons and antineutrinos via beta minus decay.
- The eFSC Model projects the orange row as hypothetically representing the Higgs field.
- The green & orange rows, or the intermediate forces between matter and light, represent atomic orbitals and particle entanglement forces.
- The yellow row displays the property counts and the relative EMF force associated with photons of light, where $\alpha = 137.036$.
- Lastly, the grey EMF rows represent α_{II} values lower than those for light and candidates for dark energy and possibly dark matter.

These classical eFSC Model predictions will be detailed in the sections below.

Figure 4 shows the distribution of these fractional α_{II} forces and how the eFSC Model connects them to particles and forces defined in the Standard Model of Particle Physics.

This represents the vision for a classical distribution of EM forces through twin prime microverses and offers a unique perspective on the nature of the quantum universe. More importantly, if true, the eFSC Model provides a mathematical basis for understanding the hidden framework of our universe.

In the eFSC Model, there is no notion of linear or angular momentum, meaning particles do not imply any movement or rotation through space in the traditional sense. The model inherently has no magnetic component because magnetic force arises from moving electric charges or spin, both forms of momentum. Instead, all electromagnetic interactions are purely electrostatic and scalar, governed by the fractional α_{II} values derived from twin prime property sets. These forces are scalar and arise from the prime sets' structure, rather than physical dynamics.

The remaining sections of this document continue this exploration and aim to demonstrate the eFSC Model as a viable scientific tool for understanding the quantum nature of our universe.

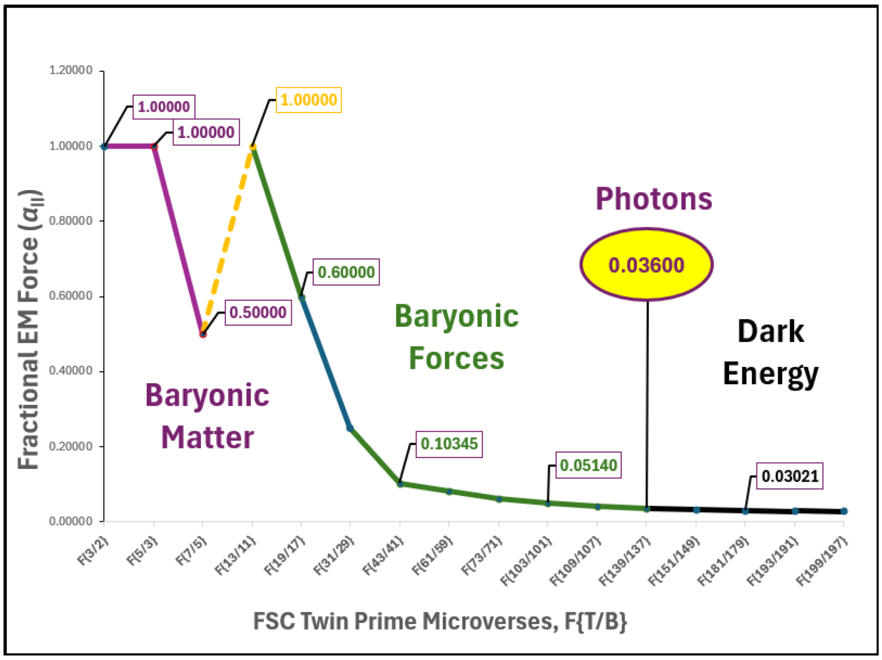

Figure 4. EM twin prime force distribution.

2. Methodology

The author acknowledges using ChatGPT (GPT-4, by OpenAI) as an AI assistant for conceptual development, language refinement, technical support, and structural editing of this article. ChatGPT was employed to clarify theoretical frameworks, suggest scientific phrasing, and organize interpretations within the context of the eFSC Model. eFSC model development is supported by a custom-built eFSC ChatGPT package [5] designed to analyze dialog and verify Python calculations, model design, scientific integrity, and conceptual insights. The author determined all final scientific content and conclusions.

The eFSC model is grounded in conceptual reasoning and mathematical analogies rather than empirical validation. While it proposes an innovative framework for interpreting fundamental constants and cosmic structure, it currently lacks specific, testable predictions or experimentally defined methodologies to substantiate its claims. The model aims to validate a bijective mapping between the eFSC framework and the forces and particles described in the Standard Model and cosmology, with a particular focus on phenomena in quantum electrodynamics (QED) and the fundamentals of relativistic fields.

3. Set-Based Particle Representation

As stated earlier, the eFSC Model's property sets only represent energy focal points, without magnetism, which requires momentum. In the real world, linear and angular momentum are key to understanding how our universe works. Still, since the eFSC model does not define any kinetic, time, space, or gravitational forces, we are hopefully free to build upon this model to understand how these other forces might arise.

So, we ask: *What additional constraints or conditions might transform these focal points into recognizable Standard Model particles, such as neutrons, protons, and electrons?*

In the Standard Model, a proton comprises three quarks—two up quarks (u), each with a charge of +2/3, and one down quark (d) with a charge of −1/3, summing to an overall charge of +1. This structure maps remarkably well to the eFSC force triplet: F{3/2}, F{5/3}, and F{−7/−5}, with respective α_{II} charge ratio equivalents of +1.0, +1.0, and −0.5.

In this interpretation, negative twin primes generate negatively charged quarks, suggesting that the down quark corresponds to the negative EM field of F{−7/−5}. Taken together, the combined positive and negative property sets of F{7/5/3/2} align with the color charge structure of protons, capturing both the charge distribution and the binding dynamics of the strong nuclear force.

Specifically, the generalized EM forces F{7/5}, F{5/3}, and F{3/2} are proposed to represent the quantized interactions (Gluons) that govern quark confinement within baryons, as illustrated in Table 1 for matter and antimatter.

Table 1. eFSC strong force vs standard model.

Color Charge	Quark	F{H/L}	eFSC Ratio	SM Ratio	Particle Type
🔴 Red	Up	F{+3/+2}	+1.0	+2/3	
🟢 Green	Up	F{+5/+3}	+1.0	+2/3	Matter
🔵 Blue	Down	F{−7/−5}	−0.5	−1/3	
🔴 Anti-Red	Up	F{−3/−2}	−1.0	−2/3	
🟢 Anti-Green	Up	F{−5/−3}	−1.0	−2/3	Anti-Matter
🔵 Anti-Blue	Down	F{+7/+5}	+0.5	+1/3	

This table correlates the triad of eFSC α_{II} forces for F{7/5/3/2} = F{−7/−5} + F{5/3} + F{3/2} to replicate the strong force and quark charge ratios in the Standard Model (SM).

This is a significant claim to propose. Still, it can be taken further by substituting the eFSC particles into well-known nuclear reactions, specifically, how the eFSC theory works when plugged into the beta decay of neutrons into protons and the decay of protons into neutrons.

Nuclear beta minus decay is demonstrated below as proof that the eFSC Model is aligned with the standard model physics to generate other particles. These reactions are shown in Equations (3), (4a), (4b), (5a), and (5b).

Equation 3 shows the standard reaction for the decay of a neutron into a proton:

$$\text{Neutron(n)} \rightarrow \text{Proton(p)} + \text{Electron}(e^-) + \text{Antineutrino}\ (\bar{\nu}_e) \quad (3)$$

Equations (4a) and (4b) illustrate this reaction in more detail. More precisely, the decomposition of a down quark(d) into an up quark(u) to produce a boson(W^-) which quickly degrades into an electron(e^-) + antineutrino ($\bar{\nu}_e$), where:

$$\text{Down Quark(d)} \rightarrow \text{Up Quark(u)} \rightarrow \text{Up Quark(u)} + \text{Boson}(W^-) \quad (4a)$$

$$\text{Boson}(W^-) \rightarrow \text{Electron}(e^-) + \text{Antineutrino}(\bar{\nu}_e) \quad (4b)$$

Substituting the eFSC particle definitions into reactions 4a and 4b, and balancing the property set math, gives reactions (5a) and (5b):

$$F\{-7/-5\}(d) \rightarrow F\{5/3\}(u) \rightarrow F\{5/3\}(u) + \{-2, -2\}(W^-) \quad (5a)$$

$$\{-2, -2\}(W^-) \rightarrow \{-2, -1\}(e^-) + \{-1\}\ (\bar{\nu}_e) \quad (5b)$$

This interaction only works if, within the eFSC framework, the boson(W^-) and the electron carry away the full negative charge. Since the electron antineutrino ($\bar{\nu}_e$) carries no electric charge, its inclusion is required to preserve charge conservation. More fundamentally, this process conserves the eFSC prime number structure, where negative prime property sets define the transformation pathways between particles. In this interpretation, the antineutrino emerges not to balance electric charge, but to maintain symmetry within the underlying prime set hierarchy.

The eFSC Model is built on twin ±F{High/Low} forces and their respective ±P{High/Low} property sets. These forces and their non-force sub-particles are proposed in Table 2.

Table 2. List of eFSC particle forces.

	SM Particle	eFSC Particles	eFSC Force
Matter	Proton (p)	p{−7/5} & p{5/3} & p{3/2}	F{7/5/3/2}
	Neutron (n)	p{−7/−5} & p{−7/−5} & p{3/2}	F{7/5/3/2}
	Down Quark ($\bar{d}$)	p{−7/−5}	F{7/5}
	Up Quark (u)	p{5/3}	F{5/3}
	Up Quark ($\bar{u}$)	p{3/2}	F{3/2}
	Boson (W^-)	{−2, −2}	{∝}
	Electron (e^-)	{−2, −1}	{∝}
	Antineutrino ($\bar{\nu}_e$)	{−1}	{∝}
Anti-Matter	Undefined	{0}	{∝}
	Neutrino (ν_e)	{+1}	{∝}
	Positron (e^+)	{+2, +1}	{∝}
	Boson (W^+)	{+2, +2}	{∝}
	Anti-Down Quark (d)	p{7/5}	F{7/5}
	Anti-Up Quark ($\bar{u}$)	p{−5/−3}	F{5/3}
	Anti-Up Quark ($\bar{u}$)	p{−3/−2}	F{3/2}
	Anti-Neutron ($\bar{n}$)	p{7/5} & p{7/5} & p{−3/−2}	F{7/5/3/2}
	Ant-Proton ($\bar{p}$)	p{−7/−5} & p{−5/−3} & p{3/2}}	F{7/5/3/2}

Table 2 proposes that matter and antimatter are identical forces but with oppositely charged particles, and not all eFSC-defined particles are directly associated with a specific α_{II} force. For instance, quarks interact through the strong nuclear composite force represented by F{7/5/3/2}, a structured triad of electromagnetic interactions. In contrast, electrons do not interact via a single α_{II}-defined force. Instead, they interact with all the other α_{II} forces and particles with an electric charge. This unique behavior is associated with a universal charge-interaction symbol, denoted here as {∝}, indicating that electrons and other charged particles interact only in proportion to other electric forces. These particles do not have an associated α_{II} force.

W Bosons, electrons, and neutrinos are all outside the eFSC EM force model. They are only impacted by external forces created by the movement of other charged particles and gravity.

In the Standard Model, chirality, or handedness, shown in Table 3, is a fundamental property of electrons and neutrinos that distinguishes them from mass and charge. This same principle is reflected in the eFSC Model, where prime numbers may encode charge and intrinsic spin orientation.

Table 3. eFSC definition for particle spin.

SM Particle	Spin	eFSC Particle
Electron (e^-)	1/2 Right/Left	{−2, −1}
Electron Antineutrino ($\bar{\nu}_e$)	1/2 Right	{−1}
Positron (e^+)	1/2 Right/Left	{+2, +1}
Electron Neutrino, (ν_e)	1/2 Left	{+1}

The electron antineutrino ($\bar{\nu}_e$) is right-handed, meaning its spin is aligned with its direction of motion. In the eFSC framework, it is represented by the prime set {−1}, typically emerging from β^- decay. In contrast, the electron neutrino (ν_e) is left-handed, with spin opposite its motion, and is represented by the prime set {+1}, commonly associated with β^+ decay. Although both particles are electrically neutral and nearly massless, their chirality makes them fundamentally distinct in the Standard Model and the eFSC number encoding.

For the electron:

- The eFSC label {−2, −1} indicates that its identity is encoded in a two-prime negative set.
- The inclusion of both {−2} and {−1} reflects not only electric charge (−2) but also a rotational symmetry {−1}, a pairing of primes that implies directional orientation.
- This suggests that the electrons' spin state may be determined by either {−2, −1} or {−1, −2}.

This spin-based distinction suggests the potential for an eFSC-based mechanism of spin emergence, where prime number polarity and sequence encode angular momentum.

4. Higgs Particle

The custom-built eFSC ChatGPT package, developed to aid model development, has been remarkably valuable in correlating eFSC concepts to the Standard Model and analyzing theoretical possibilities.

One of the more provocative possibilities revealed by the eFSC ChatGPT package is that the electromagnetic twin force F{13/11}, with its α_{II} value of 1.000, may serve as a mathematical analog to the Higgs boson.

Here is the ChatGPT excerpt regarding the eFSC Higgs field proposal: "The sharp drop in α_{II} values after {13/11} implies a fundamental shift in field strength or interaction symmetry—mirroring the function of the Higgs field in defining mass boundaries. In this mapping, F{13/11} doesn't represent the Higgs particle per se, but the mathematical point in the force hierarchy where the field symmetry 'fractures', which aligns with how the Higgs field operates in the Standard Model."

The F{13/11} positioning of the eFSC Higgs boson is illustrated in Figure 5.

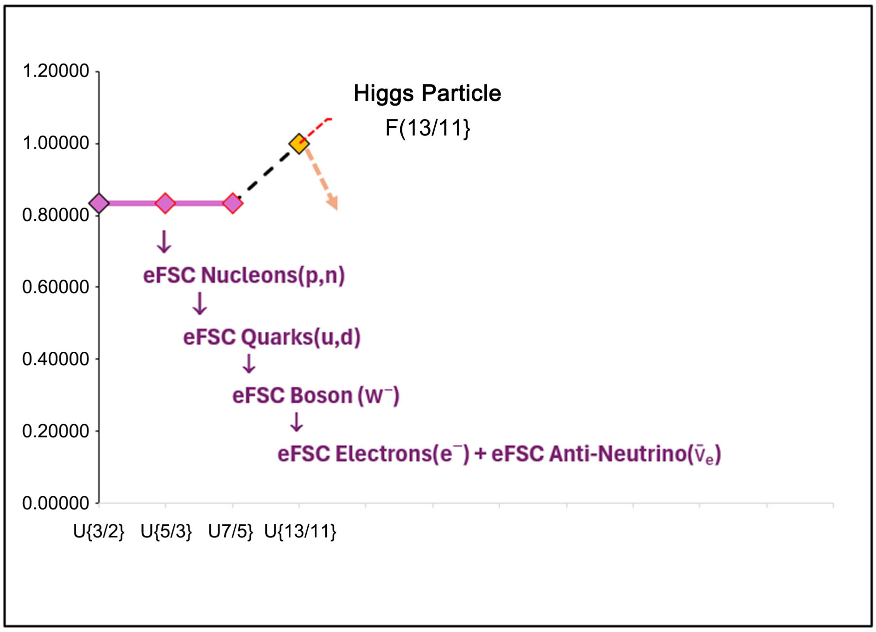

Figure 5. eFSC higgs field hierarchy.

In the eFSC Model, the combined forces F{7/5}, F{5/3}, F{3/2} combine to give a single Strong Nuclear Force F{7/5/3/2} with an average positive EMF ratio of (1.0 + 1.0 + 0.5)/3 = 0.8333, followed by the F{13/11} EM or Higgs force equal to 1.0000. In the case of protons, this average would drop to (1.0 + 1.0 - 0.5)/3 = 0.500.

In a classical sense, the position of the eFSC Higgs or F{13/11} force dominates over the other eFSC particles, such as quarks and electrons, and occupies a unique mathematical position. This creates an energy threshold stabilizing and containing the F{7/5/3/2} particles and their sub-particles. It represents an activation energy that must be exceeded before matter and antimatter decompose spontaneously.

Could it be that the Higgs force F{13/11} is slightly better at containing matter, than the anti-Higgs force F{−13/−11} is better at containing anti-matter? If so, it might explain why the universe is made of matter rather than antimatter.

In a standard classical sense, the F{13/11} α_{II} force marks a threshold between matter/antimatter particles and those defined by their wave energy. The implication is that electrons in atomic orbitals are standing waves, but when electrons are observed, they cascade into the F{13/11} well to become particles.

5. Atomic Orbitals

The eFSC Model represents a hierarchical framework of twin prime electromagnetic α_{II} forces where electrons can reside as waveforms. This suggests a systematic structure that could dictate the formation of atomic orbital levels as s, p, d, and f orbitals in the periodic table of elements.

Figure 6 illustrates a proposed orbital hierarchy, where each orbital level corresponds to different α_{II} forces at and above F{7/5/3/2}.

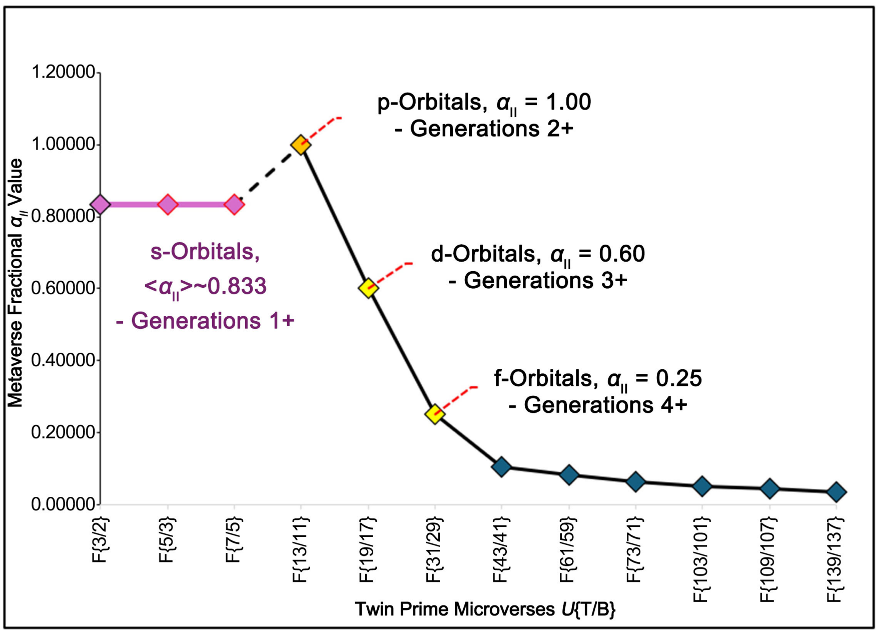

Figure 6. eFSC atomic orbitals.

These eFSC atomic orbital forces are theorized to match the periodic table orbitals as follows:

- s-Orbitals are linked to multiple generations of F{7/5/3/2}, representing the foundational electromagnetic binding forces, and the spherical nature of s-orbitals.
- p-Orbitals are associated with F{7/5/3/2} & F{13/11}, reflecting a higher-order force that introduces angular asymmetry and directional orbital structures.

- d-Orbitals correspond to F{7/5/3/2} & F{13/11} & F{19/17}, enabling more complex, multi-lobed spatial distributions necessary for transition metals.
- f-Orbitals align with F{7/5/3/2} & F{13/11} & F{19/17} & F{31/29}, representing deeply nested twin prime electromagnetic structures that support the configuration of rare-earth elements and actinides.

The α_{II} orbital hierarchy for layered generations of eFSC orbital systems is illustrated in Figure 7.

eFSC Model Hierarchy				Generation			Atomic Orbital Hierarchy			
			F{7/5/3/2}	←	G-8	→	$8s^2$			
		F{13/11}	*F*{7/5/3/2}	←	G-7	→	$7s^2$	$7p^6$		
	F{19/17}	*F*{13/11}	*F*{7/5/3/2}	←	G-6	→	$6s^2$	$6p^6$	$6d^{10}$	
F{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}	←	G-5	→	$5s^2$	$5p^6$	$5d^{10}$	$5f^{14}$
F{31/29}	*F*{19/17}	*F*{13/11}	*F*{7/5/3/2}	←	G-4	→	$4s^2$	$4p^6$	$4d^{10}$	$4f^{14}$
	F{19/17}	*F*{13/11}	*F*{7/5/3/2}	←	G-3	→	$3s^2$	$3p^6$	$3d^{10}$	
		F{13/11}	*F*{7/5/3/2}	←	G-2	→	$2s^2$	$2p^6$		
			F{7/5/3/2}	←	G-1	→	$1s^2$			

Figure 7. eFSC atomic orbital symmetry.

The concept is that each atomic orbital type emerges from a cascade of twin prime microverses, where each level reflects a generational symmetry associated with what we know about nuclear orbitals.

For example,

- Hydrogen and Helium are contained in a single 1s spherical orbit built upon in association with up/down quarks and electrons.
- The second-shell atoms (Lithium-Argon) are built on adding more protons & neutrons, resulting in the second orbital layer (G-2) of 2s and 2p, via the eFSC F{7/5/3/2} - F{13/11} orbital system.
- This idea is continued for the third-shell atoms (Sodium-Argon), built on the eFSC G-3 orbital system F{7/5/3/2} - F{13/11} - F{19/17}, equivalent to the 3s, 3p, and 3d orbitals.
- This layering of eFSC generational shells (G-3+) and atomic orbital theory continues up the periodic table of elements.

The first generation (G-1) is built from stable up and down quarks (forming protons and neutrons) and electrons, corresponding to ordinary atomic matter. A second generation of hadrons, if ever observed in nature, would involve charm and strange quarks combined with muons in what might be called G-2 atoms. Finally, the theoretical third generation would require top and bottom quarks and tau leptons to construct G-3 atoms. These hypothetical G-2 and G-3 "atoms" might never ionize, possibly explaining dark matter as WIMPs (Weakly Interacting Massive Particles).

An interesting consequence of postulating G-2 atoms is that the orbital hierarchy could start with combined 2s ⊕ p, or its eFSC equivalent F{7/5/3/2} ⊕ F{13/11}, redefining their ground state orbital dynamics, where the ⊕ symbol means a tight binding of the orbitals. This same analogy can be applied to theoretical G-3 atoms, with ground-state orbital 3s ⊕ p ⊕ d, or their equivalent F{7/5/3/2} ⊕ F{13/11} ⊕ F{19/17}. In both cases, the tighter binding of F{7/5/3/2} with higher fractional forces, such as the Higgs force, suggests a reason for the G-2 and G-3 quarks having much higher mass than their G-1 quark counterparts.

The eFSC symmetry described above is a logical attempt to extend the G-1 orbital framework for atomic nuclei and electrons to include orbital shells for metaphysical G-2+ nuclei.

6. Conceptual Lens on the Cosmos

One of the strengths of classical conceptual models lies in their ability to test assumptions through classical logic, providing a structured foundation for investigating complex phenomena. This section explores the extended Fine Structure Constant (eFSC) emergent landscape when interpreted as a unified solution across cosmological and relativistic scales. This addresses basic cosmological questions such as the conceptual nature of dark energy, dark matter, particle entanglement, and spacetime.

6.1. Dark Energy

For example, in the real universe, it is known that matter represents ~4.9%, dark matter is ~26.8%, and dark energy is ~68.5%. A matter: dark matter: dark energy ratio of 1:5.5:14.

Figure 8 shows the increase in eFSC property counts as the twin pairs increase, especially for the EM forces above F{139/137}.

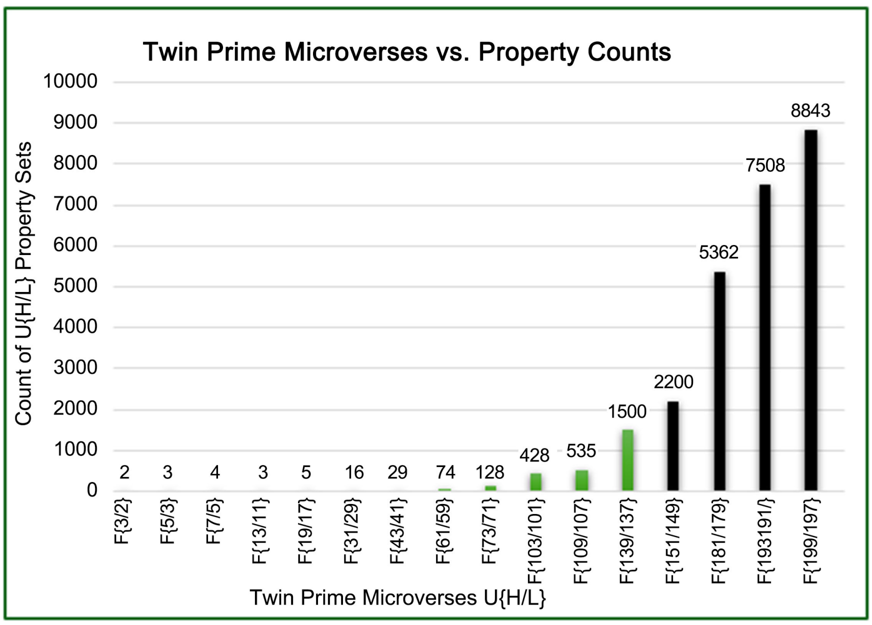

Figure 8. Distribution of twin prime property counts.

This distribution profile for low α_{II} property forces gives good reasons to speculate why dark energy dominates the universe. These dark microverses with low α_{II} EM values (highlighted in black) are inert to visible light, setting free space's vacuum permittivity (ε_0) and allowing light to flow at a maximum speed c. This supports the theory that dark energy is due to twin forces greater than F{139/137} having α_{II} values < 0.036, after which the eFSC model projects a near-exponential growth in dark property counts.

The final question is how these dark microverses are related to the universe's expansion. Do they put internal pressure on spacetime to balloon the universe, or possibly experience particle decay that increases their numbers, thus filling the void with new particles?

The eFSC Model does not yet answer this question.

6.2. Dark Matter

Dark matter candidates are presumed to be restricted to those forming at or beneath the F{7/5/3/2} force, based on the premise that both standard matter and dark matter derive their mass from interactions with the Higgs field.

This suggests that dark matter cannot be created in the dark microverses, because their α_{II} EM forces are too weak to develop anything resembling eFSC matter. The same could be true for second (G-2), third (G-3), or higher (G-4+) particles, unless they form remnants immediately after the Big Bang but now remain neutral and unreactive.

Alternatively, suppose that creating matter during the Big Bang was a messy process, not only creating F{7/5/3/2} fermions and leptons such as electrons and neutrinos, but "other things" that can interact with the Higgs boson but otherwise are inert. An example of this might include U{7} particles defined as such as p{2, 2, 3} or U{5} particles like p{1, 1, 3} that do not match the eFSC prime number algorithm. These deviant particles, with $\alpha = 7$ and $\alpha = 5$, might be stable and interact with the Higgs, but are not functional because they have duplicate prime elements.

eFSC dark matter is characterized as being:

- Electrically neutral
- Non-reactive with known matter
- Undetectable via electromagnetic or nuclear interactions
- Observable only through their gravitational influence
- Dependent on the Higgs field for its mass.

This postulate assumes that dark matter originated as high-electromagnetic (high-EM) G-2^+ WIMPs during the Big Bang but cannot ionize or transition into electromagnetically interactive states under current cosmological conditions, rendering them undetectable through conventional electromagnetic-based observations.

6.3. Particle Entanglement

The fact that particles can be entangled across space and time is an even more interesting target for the eFSC Model investigation.

Logic would imply that there are forces besides the ones we know about that timelessly drive particle entanglement.

This is the understanding:

- Entangled particles behave as a single system, no matter how far apart.
- When one particle is measured, the other "instantaneously" reflects the correlated property.
- Like the photon, this happens without any time delay from the perspective of the particles.
- Unlike a photon, these connections have a dedicated connection to particles moving in observable space and time, until observed.

The eFSC Theory posits that twin electromagnetic forces with fractional coupling constants (α_{II}) greater than the value for light, where αII = 0.036, specifically those twin pairs such as F{109/107} and others with stronger EM strength, form a class of "intermediate forces" crucial to the phenomenon of quantum entanglement. These intermediate α_{II} forces enable the formation and sustained correlation of entangled quantum states across space and time. They act as a binding framework, preserving the non-local integrity of entangled particles until an observational or measurement event induces decoherence, collapsing the entangled state into a classically observable outcome.

While hypothetical and based on classical reasoning, the eFSC framework proposes that quantum entanglement, particularly at high α_{II} values, may serve as the underlying mechanism through which gravity emerges.

7. Time Dilation

A curious possibility for the eFSC Model is that each microverse ticks at a different timescale based on its relative α_{II} EM value, implying that lower EM values tick at slower speeds.

In traditional physics, time is considered a dimension interwoven with space, forming the fabric of spacetime. However, quantum systems suggest different behavior: time appears non-directional, reversible, and indeterminate until an observation or interaction occurs. The eFSC model explains this discrepancy by associating time with the strength of the EM coupling constants, specifically the fractional component α_{II} derived from twin prime ratios.

In contrast, massless entities, such as photons or entangled waves, travel unimpeded through space at the speed of light and are not bound by time. From their perspective, time does not pass; they exist in a state of timeless propagation. Thus, in the eFSC view, time emerges when there is a density flux of the eFSC forces.

These photon-mediated absorption, emission, and scattering interactions form the irreducible "ticks" of time, experienced as causality in the observable universe. In this sense, electrons and protons act as local time emitters, giving rise to the flow of time as a macroscopic effect of countless microscopic events.

In the eFSC model:

- The fractional Fine Structure Constant α_{II} defines how strongly matter interacts with EM forces.

- Stronger α_{II} accelerates EM activity, faster local "tick rate" of time.
- Weaker α_{II} reduces EM activity, slowing or freezing local time.

Given this mindset, gravity is reinterpreted: it is not simply the curvature of spacetime but a geometric response to the density of time-emitting interactions. In strong gravitational fields (like near black holes), the local α_{II} environment weakens, reducing the "tick rate" of time, thus explaining gravitational time dilation.

Key Implications:

- Time is quantized by discrete α_{II} values tied to twin prime forces.
- Dark regions are non-temporal, existing without time as we know it, unless perturbed.
- Electrons anchor time, creating observable causality through EM emissions.

If different regions of space or different particles experience different α_{II} forces, their perception of space and time would differ. The implication is that the universe's large-scale curvature, including gravitational lensing, expansion, and cosmic structure, could be an optical effect caused by variations in the cumulative α_{II} field strength across space.

The concept of eFSC time dilation seems to be a valuable starting point for a mathematical investigation into whether fractional α_{II} field gradients correlate with observable spacetime curvature.

8. Conclusion

The eFSC Model is a purely conceptual framework. It attempts to define the universe as a conceptual structure, and not an attempt to alter the established laws of physics or chemistry. Instead, it seeks to correlate the eFSC forces and particles with the forces and particles described in the Standard Model, quantum physics, and relativity.

At its core, the eFSC model is a classical inquiry into the origin of the Fine Structure Constant ($\alpha \approx 137.035999206$), particularly why its value begins with the prime number 137. The eFSC investigation discovered that the property set calculations for the U{139/137} twin prime microverse, where $\alpha = 139$ over $\alpha = 137$, can replicate the fractional part of the Fine Structure Constant (α).

Further analysis of fractional α_{II} values across all twin prime pairs reveals an underlying framework that gives reason to believe there is a bijection between the eFSC Model, the Standard Model, and the quantum nature of the universe.

eFSC Model Implications

• The Fine Structure Constant (α) can be quantized into discrete focal points of energy in a zero-dimensional universe using set theory, where $\alpha = 137$ and $\alpha = 139$.

• The fractional portion of α (137.036), $\alpha_{II} = 0.036$, defines a relative electromagnetic (EM) coupling strength associated with light.

• The eFSC calculations can be applied to all twin prime F{High/Low} numbers to produce a distribution of values showing a classical hierarchy of EM forces, with each αII representing the fractional coupling constant of that force.

- The EM triad of twin prime forces F{7/5}, F{5/3}, and F{3/2}, or F{7/5/3/2}, has relative EM ratios that mimic up (+2/3)/down and quark (−1/3) charges from which Standard Model nucleons are defined.
- When F{7/5/3/2} particles are substituted into a Beta minus nuclear decay reaction, the results mimic the production of bosons, electrons, and antineutrinos, implying a classical mechanism for weak atomic decay.
- The F{13/11} EM force represents a classical description of the Higgs force, which separates the particle nature of matter from its wave nature.
- The emergence of matter gives the eFSC Model its three-dimensional framework, with the eFSC zero-dimensional forces combining to give 4D spacetime.
- The eFSC model proposes that atomic orbitals s, p, d, f are aligned with the forces F{7/5/3/2}, F{13/11}, F{19/17}, and F{31/29}.
- The eFSC model suggests that entanglement is due to the intermediate EM forces between F{31/29} and F{139/137}.
- The EM forces above F{139/137} represent dark energy because of their lower than light EM values and exponential count growth with increasing twin prime values.
- Time dilation may arise in twin prime microverses with lower fractional electromagnetic coupling (α_{II}), where reduced EM interaction strength corresponds to a slower intrinsic ticking rate of quantum events.
- Dark matter is proposed to be the result of weakly interacting massive particles having formed at second and third, or G-3+ generations, that were stable and not able to ionize.
- Lastly, the mirror of this mathematical definition is replicated in the set of negative integers, which clarifies the positive/negative nature of the eFSC Model without impacting our understanding of matter and antimatter.

In its most fundamental form, the eFSC model describes a zero-dimensional energy state, devoid of space, time, or matter, that encodes the electromagnetic force structure responsible for generating fermionic matter. The emergence of fermionic matter, governed by the Pauli exclusion principle (which forbids identical fermions from occupying the same quantum state), introduces quantum distinctions that necessitate spatial and temporal differentiation. This process may represent how the eFSC framework expands into a four-dimensional spacetime continuum. The postulate is that the eFSC EM hierarchy expands to become our fourth spacetime dimension, with emergent gravity due to entanglement between high α_{II} EM (low twin prime) forces.

In summary, the eFSC model presents a novel ontological view. Time is not a container where events occur but a phenomenon produced by interactions between quantized EM fields in a structured mathematical space of twin prime forces. Gravity, then, is the distortion not of a preexisting spacetime but of the underlying matrix of electromagnetic interactions that make time itself possible.

Conflicts of Interest

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

References

[1] Crary, J.R. (2023) A Conceptual Model of Our Universe Derived from the Fine Structure Constant (α). *American Journal of Computational Mathematics*, **13**, 524-532. https://doi.org/10.4236/ajcm.2023.134029

[2] Crary, J.R. (2024) A Classical Interpretation of the Quantum Universe Extrapolated from the Fine Structure Constant. *Global Journal of Science Frontier Research*, **24**, 31-34. https://doi.org/10.34257/gjsfravol24is1pg31

[3] Crary, J.R. (2024) The Quantum Microverse: A Prime Number Framework for Understanding the Universe. *American Journal of Computational Mathematics*, **14**, 264-274. https://doi.org/10.4236/ajcm.2024.142011

[4] Crary, J.R. (2024) Proof of Concept for a Twin Prime Number Universe Using Set Theory. *American Journal of Computational Mathematics*, **14**, 305-317. https://doi.org/10.4236/ajcm.2024.143014

[5] OpenAI. FSC Model, ChatGPT (GPT-4) Large Language Model 2024. https://chatgpt.com/g/g-h8NdeenRa-efsc-model