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The Quantum Microverse: A Prime Number Framework for Understanding the Universe

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Abstract

This study aims to demonstrate a proof of concept for a novel theory of the universe based on the Fine Structure Constant (α), derived from n-dimensional prime number property sets, specifically $\alpha = 137$ and $\alpha = 139$. The FSC Model introduces a new perspective on the fundamental nature of our universe, showing that $\alpha = 137.036$ can be calculated from these prime property sets. The Fine Structure Constant, a cornerstone in Quantum Electrodynamics (QED) and Quantum Chromodynamics (QCD), implies an underlying structure. This study identifies this mathematical framework and demonstrates how the FSC model theory aligns with our current understanding of physics and cosmology. The results unveil a hierarchy of α values for twin prime pairs U{3/2} through U{199/197}. These values, represented by their fraction parts $\alpha_{\text{Π}}$ (e.g., 0.036), define the relative electromagnetic forces driving quantum energy systems. The lower twin prime pairs, such as U{3/2}, exhibit higher EM forces that decrease as the twin pairs increase, turning dark when they drop below the $\alpha_{\text{Π}}$ for light. The results provide classical definitions for Baryonic Matter/Energy, Dark Matter, Dark Energy, and Antimatter but mostly illustrate how the combined $\alpha_{\text{Π}}$ values for three adjacent twin primes, U{7/5/3/2} mirrors the strong nuclear force of gluons holding quarks together.

Keywords

Fine Structure Constant, Fractional Coupling Constants, Matter/Antimatter, Dark Matter/Energy, Quantum Gravity, Prime Numbers, Set Theory

1. Introduction

The Fine Structure Constant (FSC) Model provides an abstract description of our universe based on prime numbers and classical set theory. Derived from the

Fine Structure Constant (α), it is a hypothetical framework for emergent quantum states for Baryonic Matter, Dark Matter, Dark Energy, and possibly gravity.

The premise is that the number α = 137.035999206 (~137.036), a dimensionless QED constant for the electromagnetic (EM) force, is a magical number that underlies our understanding of the universe [1]. The FSC Model [2] has identified a novel underlying mathematical solution transforming α into prime number property sets. These property sets define quantum focal points or wells where quantized energy can accumulate, thus giving our universe its underlying EM forces and quantum functionality [3].

Creating conceptual models for complex systems is nothing new, although attempting to define our universe based on classical math and logic is unique. But the fact that a Python algorithm, dimensional sets of prime numbers, and a Difference-over-Sum (DoS) calculation can replicate the real number value of α as 137.036 is compelling and warrants further attempts for alignment with the overlying physics.

Previous papers have attempted to understand how the FSC conceptual model correlates with physics by comparing real-world scientific observations and understanding with n-dimensional model predictions. This article does not represent a change in the model design but a continuing evolution of the ideas and associations required for proof of concept.

This is a continuing effort to develop a classical model of our universe. The focus is on using traditional logic, a quantum mindset, and correlation to connect the FSC Model with our scientific understanding. ChatGPT-4 was used to facilitate this effort and its relationships to physics.

2. FSC Model Description

The FSC Model starts with the proposition that prime numbers, such as 2, 3, 5, 7, 11, etc., are only divisible by one and themselves and represent stable entities underlying our natural world. Composite numbers, such as 4, 10, 25, 99, etc., which are multiples of the prime numbers, are unstable and fragment into their prime factors. This assumption includes stable sets of prime numbers, such as D03 of {3, 7, 127} or D08 of {2, 3, 5, 7, 11, 13, 37, 59} versus sets containing composite elements.

The FSC Model calculations for α are determined by assuming that its real number value is a hybrid of the twin prime microverse U{139/137}, where the U{139} α = 139 and the U{137} α = 137. A Python algorithm calculates n-dimensional prime number property sets that sum to their respective values 139 and 137 α targets.

These calculations are generalized below for the U{139/137} twin microverse but applicable to other twin prime microverses.

$$\mathrm{U}\left\{P_n/P_{n-x}\right\},\ \alpha_{\mathrm{II}} = P_{n-x} + \left(\left({}^{\#}P_n + 1\right) - \left({}^{\#}P_{n-x} - 1\right)\right) \Big/ \left({}^{\#}P_n + {}^{\#}P_{n-x}\right) \tag{1}$$

where:

- α_{II} is the calculated Fine Structure Constant for any pair of twin primes

(P_n/P_{n-2}) or (P_n/P_{n-1}).

- P_n is the upper twin prime number microverse, such as 3/2 or 139/137.
- P_{n-x} is the lower twin prime number microverse where $x = 2$, or 1, such as 3/2 or 139/137.
- ${}^{\#}P_n$ is the number of upper twin prime property sets.
- ${}^{\#}P_{n-x}$ is the number of lower twin prime dimensional property sets.

$\left({}^{\#}P_n + 1\right) - \left({}^{\#}P_{n-x} - 1\right)$ is the adjustment that hybridizes the twin prime property set counts.

Equation (1) is comprised of two parts where:

P_{n-x} represents the whole number portion, such as 137, and corresponds to the fundamental level where the absolute strength of EM force is established for each microverse.

$\left(\left({}^{\#}P_n + 1\right) - \left({}^{\#}P_{n-x} - 1\right)\right) \Big/ \left({}^{\#}P_n + {}^{\#}P_{n-x}\right)$ represents the fractional part of $\alpha_{\text{Ш}}$ that determines the relative EM forces between the P-levels and their energy differences.

The assumption is that these calculations can be repeated for all the other twin prime pairs. This results in a hierarchy of layers underlying the true nature of our universe as a conglomerate of twin prime microverses.

The calculations for each twin microverse are shown in Table 1.

Table 1. Twin Prime Microverse $\alpha_{\text{Ш}}$ & $\lfloor \alpha_{\text{Ш}} \rfloor$ Calculations.

Microverse	Prime	Sum	$\alpha_{\text{Ш}}$	$\lfloor \alpha_{\text{Ш}} \rfloor$
U{199/197}	199	4549	197.0291	0.0291
	197	4294		
U{193/191}	193	3863	191.0293	0.0293
U{181/179}	181	2761	179.0302	0.0302
	179	2601		
U{151/149}	151	1136	149.0336	0.0336
	149	1064		
U{139/197}	139	776	137.0360	0.0360
	137	724		
U{109/107}	109	278	107.0430	0.0430
	107	257		
U{103/101}	103	224	101.0514	0.0514
	101	204		
U{73/71}	73	67	71.0625	0.0625
	71	61		
U{61/59}	61	39	59.0811	0.0811
	59	35		

Continued

U{43/41}	43 41	15 14	41.1034	0.1034
U{31/29}	31 29	9 7	29.2500	0.2500
U{19/17}	19 17	3 2	17.6000	0.6000
U{13/11}	13 11	2 1	12.0000	1.0000
U{7/5}	7 5	2 2	5.5000	0.5000
U{5/3}	3	1	4.0000	1.0000
U{3/2}	2	1	3.0000	1.0000

These FSC prime number property sets do not detail how the energy of the Big Bang was dispersed, just the focal points where their particle-wave nature is most stable. It also provides a framework for contemplating how quantum coherence, such as entanglement and superposition, might be described as interconnecting relationships between the different microverse layers and their dimensional property sets.

A further projection is that each property count of twin prime pairs may reflect the energy absorbed from the Big Bang. The greater the number of twin prime pairs in each property set, the more energy it embodies. This relationship suggests that the higher-dimensional property sets D(n) for all microverses contain more energy than the lower dimensions because they have higher ratios of twin prime elements.

With that conceptual understanding, we can use classical methods to expand the FSC theory to include the Big Bang cascade and how it qualitatively correlates to real-world scientific observations.

3. The FSC Big Bang

The FSC Model is a thought experiment that attempts to develop a new perspective on how our universe started, became what it is today, and might evolve. It divides the universe's evolution into number sets using only prime number elements. These prime number sets range from single-element singularities to primordial black holes (PBHs) and finish as n-dimensional sets that outline our universe's quantum behavior at multiple levels.

The theory is that the Big Bang began with a singularity that, for all practical purposes, can be represented as a single whole number set {Googolplex}. A single number so large that it represents the sum of all quantum energy of the observable universe that, for whatever reason, cascades into fractionalized smaller prime

singularities or PBHs and releases energy.

This process is illustrated in Figure 1.

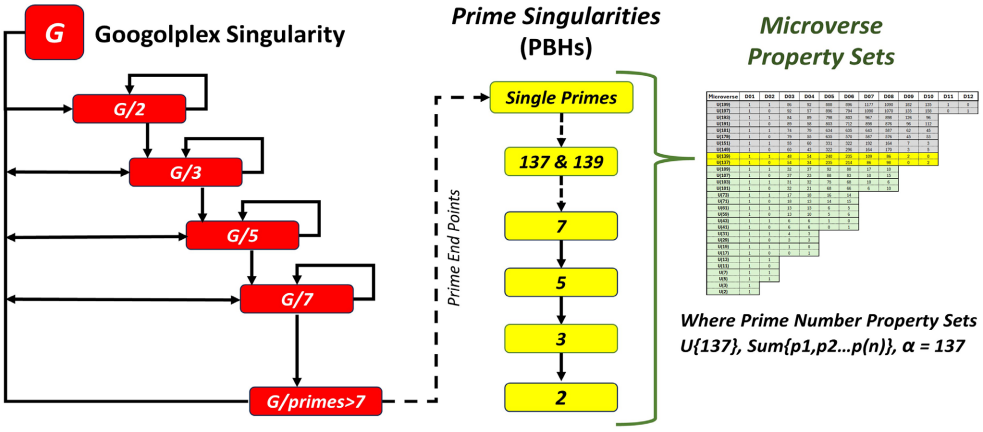

Figure 1. Prime number factorization algorithm.

The Googolplex singularity highlighted in red becomes unstable as its size increases due to the ratio of prime/composite numbers decreasing with size. It then fragments into smaller singularities, their fragmented values determined by a growing series of prime number divisors. This fragmentation releases vast amounts of energy, and the entropy quickly increases.

As shown in yellow, the Big Bang process continues, creating many one-element prime number sets or Primordial Black Holes (PHBs). These PHBs range from {2}, {3}, {5}, {7}, {11},... {137}, up to some largest prime number {p}. This process greatly favors the lower primes compared to the higher primes because 50% of whole numbers are divisible by 2, 33% divisible by 3, 20% divisible by 5, and so on up to (1/p)% divisible by the prime number p.

Lastly, the energy of the Big Bang must be converted to something more than just PHBs if the universe is ever to do anything except blow up into nonfunctional pieces. This means that the PHBs cannot be the endpoint of the bang. Instead, the energy of the Big Bang must be absorbed by growing the PHBs into n-dimensional property sets with specific α (prime number) targets.

How energy is assigned to each of these property sets, or quantum focal points, is beyond the scope of this study, except to project that the energy is distributed throughout the hierarchy in a probabilistic manner.

4. The Twin Prime Conjecture

The prime number PBHs, such as {137}, represent the starting point (D01) for n-dimensional sets of properties, each with the same $\alpha = 137$. These microverses give the universe layers of quantum functionality via the property sets defining quantum focal points of stability in both the horizontal and vertical directions.

Table 2 expands the Microverse Property Sets image in Figure 1 to show the property counts for the U{3/2} through U{199/197} and how they relate to the FSC model's current understanding of the universe.

Table 2. Microverse property counts.

Microverse	Twin Prime	D01	D02	D03	D04	D05	D06	D07	D08	D09	D10	D11	D12
U{199/197}	U{199}	1	1	86	92	888	896	1177	1090	182	135	1	0
	U{197}	1	0	92	57	896	794	1090	1070	135	158	0	1
U{193/191}	U{193}	1	1	84	89	798	803	967	898	126	96		
U{181/179}	U{181}	1	1	74	79	634	635	643	587	62	45		
	U{179}	1	0	79	55	635	570	587	576	45	53	Dark Microverses	
U{151/149}	U{151}	1	1	55	60	331	322	192	164	7	3		
	U{149}	1	0	60	43	322	296	164	170	3	5		
U{139/197}	U{139}	1	1	48	54	240	235	109	86	2	0	Light	
	U{137}	1	0	54	34	235	214	86	98	0	2		
U{109/107}	U{109}	1	1	32	37	92	88	17	10				
	U{107}	1	0	37	23	88	83	10	15				
U{103/101}	U{103}	1	1	31	32	75	68	10	6				
	U{101}	1	0	32	21	68	66	6	10				
U{73/71}	U{73}	1	1	17	18	16	14						
	U{71}	1	0	18	13	14	15						
U{61/59}	U{61}	1	1	13	13	6	5						
	U{59}	1	0	13	10	5	6						
U{43/41}	U{43}	1	1	6	6	1	0						
	U{41}	1	0	6	6	0	1		Baryonic Microverses				
U{31/29}	U{31}	1	1	4	3								
	U{29}	1	0	3	3								
U{19/17}	U{19}	1	1	1	0								
	U{17}	1	0	0	1								
U{13/11}	U{13}	1	1										
	U{11}	1	0										
U{7/5/3/2}	U{7}	1	1										
	U{5}	1	1										
	U{3}	1				Twin Prime Triplet							
	U{2}	1											

The U{139/137} microverse is highlighted in yellow to illustrate the divide between the Baryonic and Dark microverses. The Dark microverses have $\lfloor \alpha_{\text{II}} \rfloor$ values lower than $\lfloor \alpha_{137} \rfloor = 0.036$, which means they cannot absorb or emit light as we know it. The Baryonic microverses have $\lfloor \alpha_{\text{II}} \rfloor$ values higher than $\lfloor \alpha_{137} \rfloor$ and, therefore, have EM forces that capture and retain light energy.

This study focuses on fractional $\lfloor \alpha_{\pi} \rfloor$ values, such as $\lfloor \alpha_{137} \rfloor = 0.036$ rather than $\alpha = 137.036$, to reflect their relative EM forces rather than their absolute EM values. For example, a plausible measure of transitional energy would involve $\lfloor \alpha_{71} \rfloor$ - $\lfloor \alpha_{17} \rfloor$ using the fractional values 0.0625 - 0.6000 or a $\Delta\lfloor \alpha_{\pi} \rfloor = -0.5375$. Presuming that these layers are all entangled, the energy released as a photon would be a function of $\int(\Delta\lfloor \alpha_{\pi} \rfloor)$ and the specific U{73/71} & U{19/17} property sets involved in the transition.

Figure 2 illustrates how the fractional $\lfloor \alpha_{\pi} \rfloor$ values change with twin prime microverse, showing what appears to be a well-defined trend of changing EM forces.

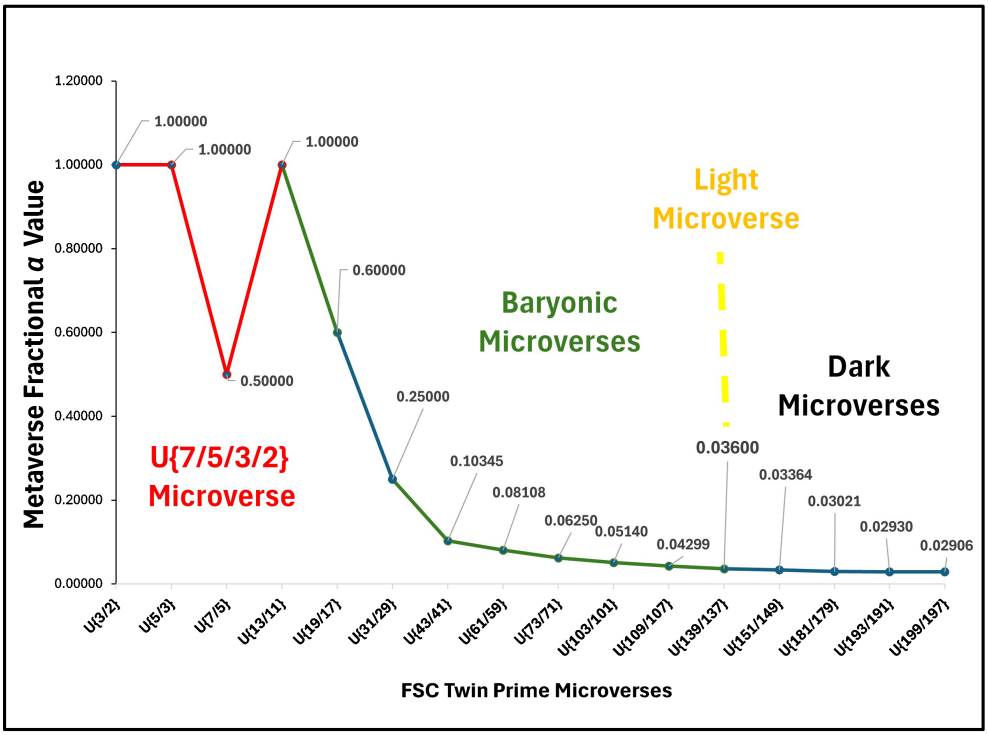

Figure 2. Twin Prime Microverse Fractional α_{π} Values.

The first observation is that the fractional $\lfloor \alpha_{\pi} \rfloor$'s start high and decrease as the twin prime values increase. Once the $\lfloor \alpha_{\pi} \rfloor$ drops below that of light where $\lfloor \alpha_{\pi} \rfloor = 0.036$, it can no longer interact with the Baryonic matter and goes dark.

This relationship gives reason to believe that all $\lfloor \alpha_{\pi} \rfloor$ EM values represent the same force but at different strengths based on the relative position in the hierarchy.

5. Dark Microverses

The implication is that the Dark microverses characterize the vacuum of space, which is not empty but has EM properties that are too weak to interact with light. Although the Dark microverses have no visible properties, the FSC Model concludes their cumulative effect will merge with the Baryonic microverses.

Gravity and Dark Energy are different forces of nature, possibly emergent from the fact that all the microverses are very similar, except for their relative $\lfloor \alpha_{\pi} \rfloor$ values and property counts. The difference between gravity and expansion can be related to whether the different property sets attract or are repelled. If they attract, we have gravity; if they repel, we have expansion. If they attract, repel, or change over time, the overall impact depends on which one dominates space.

Observations that our universe is a network of galaxies surrounding large voids would indicate that both attraction and repulsion interactions are at play. If true, and the Dark microverses change over time, it might alter our perception of the past. For example, the Magnetic Permeability of a Vacuum (μ_0) is a critical component of Maxwell's equations, which describe the behavior of electric and magnetic fields. This and the Vacuum Permittivity constant (ϵ_0) are used to calculate the speed of light, where:

$$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}} \tag{2}$$

This consideration would suggest that if the Dark microverses changed over time, so might ϵ_0 and thus the speed of light. How this might explain emergent spacetime is unknown.

6. Baryonic Microverses

The Baryonic microverses have $\lfloor \alpha_{\pi} \rfloor$ values higher than light, meaning they have stronger EM forces. As such, they hold on to their energy tighter with the lower twin microverses.

The U{7/5/3/2} microverse is particularly interesting because it represents the only place in the FSC hierarchy where three twin prime pairs overlap. This implies that they are more entangled than the isolated twin prime microverses. So, instead of referencing them separately as U{7/5}, U{5/3}, and U{3/2}, they can be thought of as a single quantized entity U{7/5/3/2}.

The first impression is that the values 1, 1, and 0.5 for U{3/2}, U{5/3}, and U{7/5} were mathematical anomalies, and it is better to average them to gain a true perspective on their combined quantum nature. That would have been a mistake!

This is because U{7/5/3/2} values {1,1,0.5} mimic a significant QED observation—the charge combinations for Hadrons, which define quark configurations of neutrons and protons in the Standard Model.

The Charge Combinations for Protons and Neutrons are defined below.

- **Protons**
  - Composed of two up quarks and one down quark (*uud*)
  - Total charge: +2/3 + +2/3 + −1/3 = +1
- **Neutrons**
  - Composed of one up quark and two down quarks (*udd*)
  - Total charge: +2/3 + −1/3 + −1/3 = 0

With a bit of pattern matching, the U{7/5/3/2} EM forces {1, 1, 0.5} are proportional to the quark charges {2/3, 2/3, −1/3} and factor to give the same ratios. It is a match, except for the $\lfloor \alpha_5 \rfloor$ charge being +0.5 instead of −0.5, but that depends on perspective. Internally it might imply U{3/2} = 1.0 and U{5/3} = 1.0, and U{7/5} = −0.5.

Looking closer at the similarities, we compare how the U{7/5/3/2} triplet might describe Up/Down Quarks as shown below:

$$\begin{aligned} \mathrm{U}\{7/5/3/2\} &\to \mathrm{U}\{7/5\}, \mathrm{U}\{5/3\}, \mathrm{U}\{3/2\} \\ &\to \{\text{Down Quark, Up Quark, Up Quark}\} \end{aligned} \tag{3a}$$

If correct, then it would imply the following:

$$\mathrm{U}\{7/5\} + \mathrm{U}\{7/5\} + \mathrm{U}\{3/2\} \to \text{Neutron} \tag{3b}$$

$$\mathrm{U}\{7/5\} + \mathrm{U}\{5/3\} + \mathrm{U}\{3/2\} \to \text{Proton} \tag{3c}$$

From this definition, the decay of Neutrons with a half-life of 14 minutes into protons could be defined as follows.

$$\begin{aligned} &\text{Neutron}\left(\mathrm{U}\{7/5\} + \mathrm{U}\{7/5\} + \mathrm{U}\{3/2\}\right) \\ &\to \text{Proton}\left(\mathrm{U}\{7/5\} + \mathrm{U}\{5/3\} + \mathrm{U}\{3/2\}\right) + e^{-} + \nu^{-}e \end{aligned} \tag{4}$$

The mechanism by which U{7/5} decays to U{5/3} + e^{-} + $\nu^{-}e$ is not defined, but lone Neutrons having two identical U{7/5} quarks or gluons suggests it is an unstable configuration. This suggests there is an underlying math that describes the particle physics involved. If so, it should be possible to convert Feynman diagrams of particle interactions into simplified field equations.

The FSC Model also suggests that each microverse layer is a separate force that can entangle with the others to reflect reality. For example, the triplet U{7/5/3/2} with three different EM forces might combine to reflect the Strong Nuclear Force.

7. Antimatter

The final question to ponder is how the FSC Model might describe Antimatter.

Assuming matter is defined as U{Top/Bottom} twin primes, it seems reasonable to speculate that antimatter would be the negative mirror image U{−Top/−Bottom} prime. But the problem with his assumption is that Matter/Antimatter reactions would tend to produce U{0, 0} type products. This is inconsistent with the FSC Model as currently defined. If so, the Big Bang would have left nothing behind. There might also be a case for matter being +U{Top/Bottom} and antimatter being −U{Top/Bottom}, but the math only appears to produce the empty set {ϕ}.

The most compatible definition for antimatter is that matter is defined as U{Top/Bottom}, while antimatter is represented as the inverse of matter, or U{Bottom/Top}. This gives Matter and Antimatter a unique symmetry and similar property set definitions, yet to be clarified.

This FSC Model assumption concludes that the Big Bang produced matter

and antimatter. However, because the count of upper twin property sets is always greater than that of lower twin property sets, the only possible outcome is that we will end up with a U{Top/Bottom} or matter-dominated universe.

8. Conclusions

This study began as a curiosity about why the Fine Structure Constant (α) equal to 137.035999206 began with a prime number. Over the past two years, the FSC Model has evolved as an attempt to correlate a conceptual model of our universe to the overlying physics.

The FSC Model gives a conceptual description for the forces that drive our universe, such as:

- Baryonic matter & energy are due to the microverses U{7/5/3/2} through U{139/137} having $\lfloor \alpha_{\pi} \rfloor$ values greater than or equal to that of light where $\lfloor \alpha_{137} \rfloor = 0.036$.
- Dark matter and energy are defined as axions having $\lfloor \alpha_{\pi} \rfloor$ values lower than light, where $\lfloor \alpha_{137} \rfloor = 0.036$, and are dark because they do not absorb or emit light.
- The triplet forces for U{7/5}, U{5/3}, and U{3/2} combine to form a hybrid U{7/5/3/2} force that seems to replicate the strong force and color charges binding Up and Down Quarks together.
- Gravity emerges from some property sets for the Baryonic and Dark microverses having mutual attraction, while cosmic expansion due to the Dark microverses having property sets that repel. This postulate is supported by the observations that our universe is divided into large networks of galaxies separated by large voids. Much like oil dispersed in water, they separate into phases based on their relative ratios and polarity. In this case, the cosmic voids favor property sets that repel, while the galactic networks result from both Baryonic and Dark Matter property sets having net attraction.
- The difference between Matter and Antimatter is best described as Matter having U{Top Prime/Bottom Prime} configuration and Antimatter having the inverse configuration U{Bottom Prime/Top Prime}. Since the top twin always produces more property sets than the lower twin, matter was destined to dominate our universe.

The FSC Model predicts that the Baryonic microverses are entangled layers of energy-filled property sets and a hierarchy of forces that interact to give us a functional universe. If true, this would give us a novel perspective on the quantum nature of our universe and new mathematical possibilities for quantifying its behavior.

Lastly, the FSC theory is a hypothetical study attempting to align n-dimensional prime number property sets to real-world scientific observations. It hopes to develop a new paradigm for consideration based on the knowledge that the Fine Structure Constant (α) value can be transformed into discrete values for observable quantities.

Again, this study has been driven by the thought, "How magical would it be if the universe provided a logical framework for understanding why it exists."

Conflicts of Interest

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

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