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# A Conceptual Model of Our Universe Derived from the Fine Structure Constant ($\alpha$)

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## Abstract

The Fine Structure Constant ($\alpha$) is a dimensionless value that guides much of quantum physics but with no scientific insight into why this specific number. The number defines the coupling constant for the strength of the electromagnetic force and is precisely tuned to make our universe functional. This study introduces a novel approach to understanding a conceptual model for how this critical number is part of a larger design rather than a random accident of nature. The Fine Structure Constant (FSC) model employs a Python program to calculate n-dimensional property sets for prime number universes where $\alpha$ equals the whole number values 137 and 139, representing twin prime universes without a fractional constant. Each property is defined by theoretical prime number sets that represent focal points of matter and wave energy in their respective universes. This work aims to determine if these prime number sets can reproduce the observed $\alpha$ value, giving it a definable structure. The result of the FSC model produces a $\alpha$ value equal to 137.036, an almost exact match. Furthermore, the model indicates that other twin prime pairs also have a role in our functional universe, providing a hierarchy for atomic orbital energy levels and alignment with the principal and azimuthal quantum numbers. In addition, it construes stable matter as property sets with the highest ratio of twin prime elements. These results provide a new perspective on a mathematical structure that shapes our universe and, if valid, has the structural complexity to guide future research.

## Keywords

Fine Structure Constant, Conceptual Model, Prime Numbers, Property Sets, Quantum, Physics, Universe

## 1. Introduction

"One hundred thirty-seven is the inverse of something called the fine-structure constant. …The most remarkable thing about this remarkable number is that it is dimension-free. …Werner Heisenberg once proclaimed that all the quandaries of quantum mechanics would shrivel up when 137 was finally explained." —quote by Leon M. Lederman, The God Particle.

The Fine Structure Constant has been the subject of numerous articles over the past century, best described by the NIST Reference on Constants, Units, and Uncertainty [1]. This number represents the electromagnetic force and is fundamental to quantum electrodynamics (QED) and our understanding of the standard model of quantum physics.

This study began after watching a PBS Space Time video [2] and wondering why the Fine Structure Constant ($\alpha$) of 137.035999206 started with the prime number 137. Many scientifically minded people have noticed this "feature" but never considered it an indication of anything important, just a dimensionless number without definition. Instead, investigations have involved measuring its value more precisely to support QED predictions and mathematical models, but few looked for an underlying structure for the value of $\alpha$ itself.

There are studies [3] [4] to identify mathematical structures that reproduce the number, including some using prime numbers, but nothing with the scope of developing a model to describe an underlying structure.

This study is more computer science than physics. Still, it implies an inherent mathematical system that defines the Fine Structure Constant, albeit somewhat unusual, aligned with prime numbers and set theory.

## 2. The Fine Structure Constant (FSC) Model

The FSC Model is a product of conceptualizing how the prime number 137 might be reflected in a multi-dimensional universe. It is best defined by property sets for each dimension D(n), where the number of the property set elements (n) matches the cardinality of the parent dimensions. If the sum of the property elements equals the target $\alpha$ (e.g., 137), and if the property elements are all prime numbers, it defines matter in a 137 or U{137} universe.

Consider the possibility that we live in a U{137} universe where the Fine Structure Constant is a whole number 137 without the fractional part. This prime number universe can be modeled using the algorithm shown in **Figure 1**.

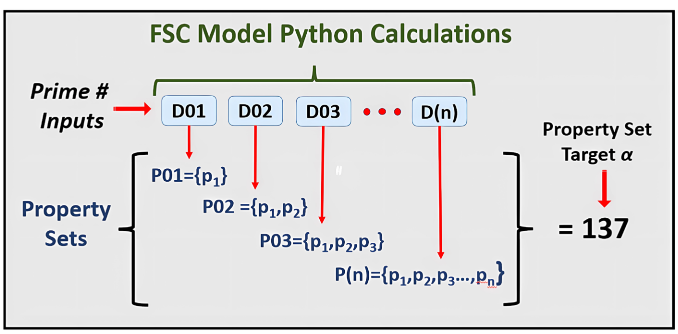



**Figure 1.** Property set calculations.

A Python program was created to generate FSC property sets based on code "All unique combinations whose sum equals to K" [5] designed to calculate the property sets for any prime number universe. Given an input set of prime numbers and a target *α*, the program generates a property set file for each D(n) dimension, summarizes the results in a metafile, and then pivots those results into a CSV file for analysis in Excel.

The Python program generates the D01-D(n) property sets for a U{137} universe where the sum of each property set has an *α* equal to 137. If the input is the set of prime numbers {2…137} and the *α* target is 137, the output defines matter for a 137-universe. The same is true for U{139}, where the sum of each property set equals 139 for a 139-universe. The critical thing to understand is that 137 and 139 are twin primes, giving them a unique mathematical relationship with implied analytics and logic.

The rationale for this model is that prime numbers define stable matter because they are only divisible by one and themselves. Composite numbers such as 10, 50, or 232 are unstable and quickly decay to the prime number remnants, such as 2, 3, and 5. The result is a universe dominated by prime-number entities.

The question now becomes, can the Fine Structure Constant (FSC) Model property sets replicate the real-world Fine Structure Constant (*α*) = 137.035999206?

## 2.1. FSC Model Property Analysis

The Python-generated property counts for U{139} and U{137} are shown in **Table 1** and illustrate how the whole number math characterizes their unique association.

**Table 1.** FSC model—fine structure constant calculation.

| Universe | D01 | D02 | D03 | D04 | D05 | D06 | D07 | D08 | D09 | D10 | Sum | Calculated *α* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U{139} | 1 | 1 | 48 | 54 | 240 | 235 | 109 | 86 | 2 | 0 | 776 | 137.034666667 |
| U{137} | 1 | 0 | 54 | 34 | 235 | 214 | 86 | 98 | 0 | 2 | 724 | |
| where $\alpha = 137 + (776 - 724)/(776 + 724) = 137.034666667$ | | | | | | | | | | | | |

The effort is to identify a coupling of the U{139} and U{137} property sets that calculates the real-world *α* by using the property counts to estimate the fractional part. If the whole number math is correct, the FSC Model should be able to calculate the real-world Fine Structure Constant (*α*).

The fractional part of *α* in **Table 1** is only a 96% match and not an adequate model to calculate the value observed in nature. Additionally, this model does not provide an agency for combining the U{139} and U{137} parallel universes into a single U{139/137} hybrid. They are still separate entities, no different from isolated primes such as 113 generating a U{113} universe without a viable *α*.

## 2.2. Hybrid FSC Model Property Analysis

However, some intriguing anomalies exist in the D02 property sets for U{139} and U{137}. The U{137} D02 results did not produce any properties. The details of this observation are shown in Table 2 and a projection of what it means for our FSC Model.

Table 2. Twin universe coupling.

| Universe | D01 | D02 | D(n) |
|---|---|---|---|
| U{139} | {139} | {2,137} ↓ | … |
| D02 Bleed → | | {137} | |
| ~~U{137}~~ | ~~{137}~~ | {} | … |

Table 3. Revised FSC model—fine structure constant calculation.

| Universe | D01 | D02 | D03 | D04 | D05 | D06 | D07 | D08 | D09 | D10 | Sum | Calculated $\alpha$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U{139} | 1 | 1<br>1 | 48 | 54 | 240 | 235 | 109 | 86 | 2 | 0 | 777 | 137.036000000 |
| | U{137} | 0 | 54 | 34 | 235 | 214 | 86 | 98 | 0 | 2 | 723 | |
| where $\alpha = 137 + (777 - 723)/(777 + 723) = 137.036000000$ | | | | | | | | | | | | |

If instead of U{137} following a separate parallel path for property generation, what if the D02 property {137} is bled from the U{139} D02 property {2,137}?

The migration of a single {137} property from U{139} into U{137} alters the FSC Model and their respective property counts. This revision adds one additional property "{137}" to U{139} and subtracts it from the U{137} universe, giving the new results shown in Table 3.

This change to the property counts results in the revised calculation generating 137.036000000 compared to the real-world $\alpha$ of 137.035999206. The calculated fraction of $\alpha$ represents a 22-ppm deviation from the observed fractional value.

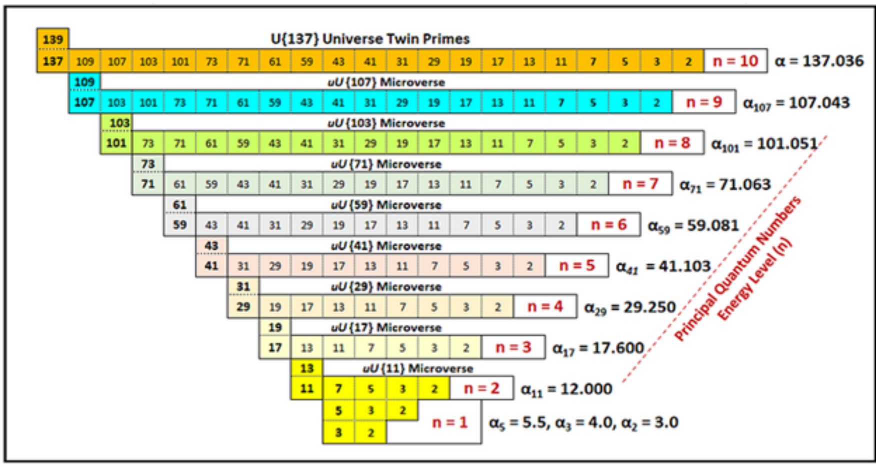
This revised definition illustrates how the U{139} and U{137} universes must be a hybrid of functionality and inseparably coupled. The ability of the FSC Model to reproduce the scientifically measured Fine Structure Constant ($\alpha$) is a critical requirement for FSC Model validation. This demonstrates that the Fine Structure Constant has an underlying structure that can replicate the number 137.035999206 almost exactly.

## 3. The Twin Prime Conjecture

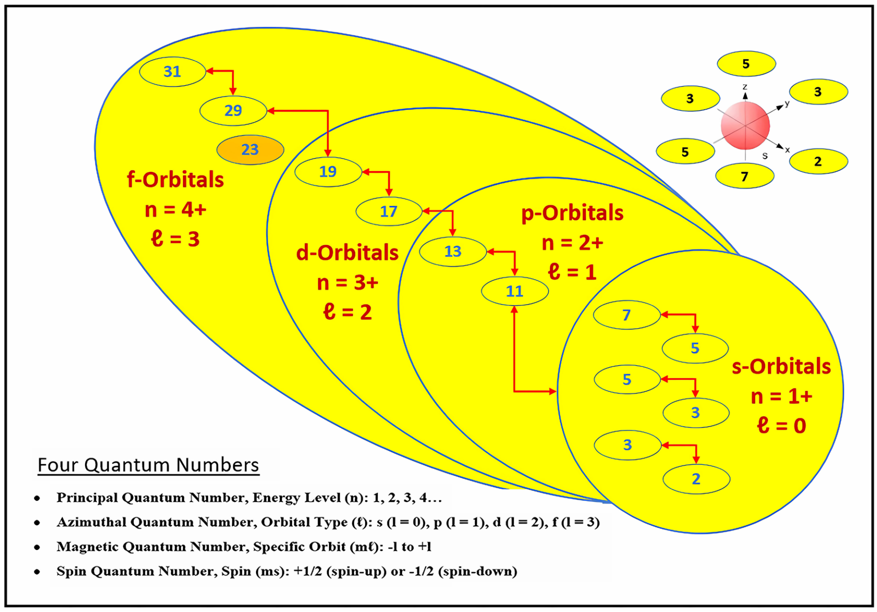
If the Fine Structure Constant functionality results from coupling the twin primes 139 and 137 universes, can that same coupling be applied to the lower twin primes?

Consider the twin prime hierarchy shown in Figure 2(a).

This illustrates the nine microverses (uU) embedded inside the U{139/137} universe and provides multiple layers of functionality. This would imply that each twin prime layer represents different energy levels and can be aligned with the Principal Quantum Numbers (n) of quantum mechanics. To illustrate this




(a)




(b)

**Figure 2.** (a) Universe twin prime hierarchy; (b) Definition of twin prime atomic orbitals.

further, the same math used to calculate the $\alpha$ for U{139/137} also works for these subordinate twin pairs, suggesting another measure of the functional differences between the layers.

But most exciting are the triplet twin primes {2-3}, {3-5}, and {5-7} at the end of each microverse, best illustrated in n-levels 1 and 2 and highlighted in yellow. These are the locations in the twin prime hierarchy where we get three twin pairs adjacent to and overlapping with each other. This suggests a complex quantum environment rich with possibilities.

The definition for twin prime atomic orbitals is illustrated in Figure 2(b).

The current postulate is that the {2-3-5-7} prime triplets can define s-orbitals at multiple microverse energy levels for n =1 and higher. Overlapping {2-3-5-7} with {11-13} depicts the p-orbitals, including the twin pairs {17-19} and {29-31} produces the d- and f-orbitals.

The rationale is that if the {2-3}, {3-5}, and {5-7} twin prime pairs are depicted as 3-perpendicular vectors, it gives the s-orbitals their spherical 3D embodiment and an x, y, and z spatial coordinate system.

## 4. The Logic of Property Sets

The property sets are unitless sets of prime numbers, including twin primes. Most interesting is that their ratio of twin primes increases as the property sets increase in size D(n). The reason is that the higher the dimensions, the lower the prime numbers used to match the target $\alpha$. Since the lower primes have a higher twin character, it is only logical that this is reflected in the composition of the property sets.

This effect is illustrated in Figure 3(a) for a portion of the U{137} property sets with the twin prime pairs highlighted in yellow.

The theoretical implication is that property set functionality increases with the number of twin primes, mainly if they include the twin triplet {2-3-5-7}. How this manifests itself in a classical definition of quantum behavior is unknown,

**D01-D04**

| 1D: D01 | 2D: D01 | 2D: D02 | 3D: D01 | 3D: D02 | 3D: D03 | 4D: D01 | 4D: D02 | 4D: D03 | 4D: D04 |
|---|---|---|---|---|---|---|---|---|---|
| | | | 11 | 13 | 113 | | | | |
| 137 | 2 | 137 | 17 | 59 | 61 | 2 | 3 | 5 | 127 |
| | | | 41 | 43 | 53 | | | | |

**D05**

| D01 | D02 | D03 | D04 | D05 |
|---|---|---|---|---|
| 3 | 5 | 7 | 13 | 109 |
| 3 | 5 | 7 | 19 | 103 |
| 3 | 5 | 7 | 43 | 79 |

**D06**

| D01 | D02 | D03 | D04 | D05 | D06 |
|---|---|---|---|---|---|
| 2 | 3 | 5 | 7 | 11 | 109 |
| 2 | 3 | 5 | 7 | 13 | 107 |
| 2 | 3 | 5 | 7 | 17 | 103 |
| 2 | 3 | 5 | 7 | 19 | 101 |
| 2 | 3 | 5 | 7 | 23 | 97 |
| 2 | 3 | 5 | 7 | 31 | 89 |
| 2 | 3 | 5 | 7 | 37 | 83 |
| 2 | 3 | 5 | 7 | 41 | 79 |
| 2 | 3 | 5 | 7 | 47 | 73 |
| 2 | 3 | 5 | 7 | 53 | 67 |
| 2 | 3 | 5 | 7 | 59 | 61 |

**D07**

| D01 | D02 | D03 | D04 | D05 | D06 | D07 |
|---|---|---|---|---|---|---|
| 3 | 5 | 7 | 11 | 13 | 19 | 79 |
| 3 | 5 | 7 | 11 | 13 | 31 | 67 |
| 3 | 5 | 7 | 11 | 13 | 37 | 61 |
| 3 | 5 | 7 | 11 | 17 | 23 | 71 |
| 3 | 5 | 7 | 11 | 17 | 41 | 53 |
| 3 | 5 | 7 | 11 | 19 | 31 | 61 |
| 3 | 5 | 7 | 11 | 23 | 29 | 59 |
| 3 | 5 | 7 | 11 | 23 | 41 | 47 |
| 3 | 5 | 7 | 11 | 31 | 37 | 43 |
| 3 | 5 | 7 | 13 | 17 | 19 | 73 |
| 3 | 5 | 7 | 13 | 17 | 31 | 61 |
| 3 | 5 | 7 | 13 | 19 | 23 | 67 |
| 3 | 5 | 7 | 13 | 19 | 29 | 61 |
| 3 | 5 | 7 | 13 | 19 | 31 | 59 |
| 3 | 5 | 7 | 13 | 19 | 37 | 53 |
| 3 | 5 | 7 | 13 | 19 | 43 | 47 |
| 3 | 5 | 7 | 13 | 29 | 37 | 43 |
| 3 | 5 | 7 | 13 | 31 | 37 | 41 |
| 3 | 5 | 7 | 17 | 23 | 29 | 53 |
| 3 | 5 | 7 | 19 | 23 | 37 | 43 |
| 3 | 5 | 7 | 19 | 29 | 31 | 43 |

**D08**

| D01 | D02 | D03 | D04 | D05 | D06 | D07 | D08 |
|---|---|---|---|---|---|---|---|
| 2 | 3 | 5 | 7 | 11 | 13 | 17 | 79 |
| 2 | 3 | 5 | 7 | 11 | 13 | 23 | 73 |
| 2 | 3 | 5 | 7 | 11 | 13 | 29 | 67 |
| 2 | 3 | 5 | 7 | 11 | 13 | 37 | 59 |
| 2 | 3 | 5 | 7 | 11 | 13 | 43 | 53 |
| 2 | 3 | 5 | 7 | 11 | 17 | 19 | 73 |
| 2 | 3 | 5 | 7 | 11 | 17 | 31 | 61 |
| 2 | 3 | 5 | 7 | 11 | 19 | 23 | 67 |
| 2 | 3 | 5 | 7 | 11 | 19 | 29 | 61 |
| 2 | 3 | 5 | 7 | 11 | 19 | 31 | 59 |
| 2 | 3 | 5 | 7 | 11 | 19 | 37 | 53 |
| 2 | 3 | 5 | 7 | 11 | 19 | 43 | 47 |
| 2 | 3 | 5 | 7 | 11 | 29 | 37 | 43 |
| 2 | 3 | 5 | 7 | 11 | 31 | 37 | 41 |
| 2 | 3 | 5 | 7 | 13 | 17 | 19 | 71 |
| 2 | 3 | 5 | 7 | 13 | 17 | 23 | 67 |
| 2 | 3 | 5 | 7 | 13 | 17 | 29 | 61 |
| 2 | 3 | 5 | 7 | 13 | 17 | 31 | 59 |
| 2 | 3 | 5 | 7 | 13 | 17 | 37 | 53 |
| 2 | 3 | 5 | 7 | 13 | 17 | 43 | 47 |
| 2 | 3 | 5 | 7 | 13 | 19 | 29 | 59 |
| 2 | 3 | 5 | 7 | 13 | 19 | 41 | 47 |
| 2 | 3 | 5 | 7 | 13 | 23 | 31 | 53 |
| 2 | 3 | 5 | 7 | 13 | 23 | 37 | 47 |
| 2 | 3 | 5 | 7 | 13 | 23 | 41 | 43 |
| 2 | 3 | 5 | 7 | 13 | 29 | 31 | 47 |
| 2 | 3 | 5 | 7 | 13 | 29 | 37 | 41 |
| 2 | 3 | 5 | 7 | 17 | 19 | 23 | 61 |
| 2 | 3 | 5 | 7 | 17 | 19 | 31 | 53 |
| 2 | 3 | 5 | 7 | 17 | 19 | 37 | 47 |
| 2 | 3 | 5 | 7 | 17 | 19 | 41 | 43 |
| 2 | 3 | 5 | 7 | 17 | 23 | 37 | 43 |
| 2 | 3 | 5 | 7 | 17 | 29 | 31 | 43 |
| 2 | 3 | 5 | 7 | 19 | 23 | 31 | 47 |
| 2 | 3 | 5 | 7 | 19 | 23 | 37 | 41 |
| 2 | 3 | 5 | 7 | 19 | 29 | 31 | 41 |
| 2 | 3 | 5 | 7 | 23 | 29 | 31 | 37 |

**D09**

| U{139} Properties | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| D01 | D02 | D03 | D04 | D05 | D06 | D07 | D08 | D09 |
| 3 | 5 | 7 | 11 | 13 | 17 | 19 | 23 | 41 |
| 3 | 5 | 7 | 11 | 13 | 17 | 23 | 29 | 31 |

**D10**

| U{137} Properties | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D01 | D02 | D03 | D04 | D05 | D06 | D07 | D08 | D09 | D10 |
| 2 | 3 | 5 | 7 | 11 | 13 | 17 | 19 | 23 | 37 |
| 2 | 3 | 5 | 7 | 11 | 13 | 17 | 19 | 29 | 31 |

(a)

**U{139} Properties**

| D01 | D02 | D03 | D04 | D05 | D06 | D07 | D08 | D09 |
|---|---|---|---|---|---|---|---|---|
| 3 | 5 | 7 | 11 | 13 | 17 | 19 | 23 | 41 |
| 3 | 5 | 7 | 11 | 13 | 17 | 23 | 29 | 31 |

**U{137} Properties**

| D01 | D02 | D03 | D04 | D05 | D06 | D07 | D08 | D09 | D10 |
|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 | 5 | 7 | 11 | 13 | 17 | 19 | 23 | 37 |
| 2 | 3 | 5 | 7 | 11 | 13 | 17 | 19 | 29 | 31 |

(b)

Figure 3. (a) Partial list of U{139/137} property sets; (b) U{139/137} D09 & D10 property set functionality.

except to say that each property set represents packets of stable U{137} energy or quantum fields. The theory is that the greater the number of twin primes, the more matter like the energy packets, providing some rationale for particle-wave duality.

Most interesting are the U{139/137} property sets D09 and D10 because they have the highest ratios of twin primes and presumably the most functionality. These property sets are shown in **Figure 3(b)**.

These two property sets are unique because the U{137} Python calculations only generate 2-D10 property sets but no D09 properties. The opposite is true for U{139}, with 2-D09 property sets and no D10 properties.

This again illustrates the separate but hybrid nature of the U{139/137} universe as the FSC Model produces the final property sets. The four of them are almost entirely populated with twin prime pairs. Speculation might suggest that they are aligned with three of the four forces of nature, but that is beyond the scope of this investigation.

One might speculate that U{139} and U{137} are parallel and highly coupled. Their property sets differ slightly since they have different whole number $\alpha$ values, 139 and 137. It would be an entirely new paradigm to consider that the U{139} property sets represent antimatter while the U{137} property sets create matter as we know it. If this postulate is true, then classical logic and math would be able to describe matter/antimatter reactions of particle physics. This possibility is yet to be determined.

## 5. Matter, Dark Matter, and Dark Energy

Finally, additional calculations suggest that the universe's composition can be calculated from U{137} property sets. This estimate is shown in **Table 4** using subset math.

These percentages are based on a trial series where the Python input includes prime numbers with increasing non-prime values, such as 1, 4, 6, 8, and 9. These represent the possibility that property sets might consist of duplicate prime elements such as 1, 2, or 3, thus breaking the U{139/137} coupling to create dark matter. The idea is that composite elements such as four might be in equilibrium with 4 ↔ 2 + 2, thus changing their dimensionality. Property sets containing composite numbers would alter between D(n) and D(n + 1) and not be able to couple with U{139} properties.

**Table 4.** Estimate of U{137} Cumulative D10 Composition.

| Trial Input | FSC Implication | D10 | Avg D10 | % Calculated | % Observed |
|---|---|---|---|---|---|
| Primes | Matter | 724 | 724 | 5.1% | 5% |
| Primes, Plus 1 | Dark Matter | 1423 | 4328 | 25.3% | 27% |
| Primes, Plus 1, 4 | | 2670 | | | |
| Primes, Plus 1, 4, 6 | | 4837 | | | |
| Primes, Plus 1, 4, 6, 8 | | 8382 | | | |
| Primes, Plus 1, 4, 6, 8, 9 | Dark Energy | 14,249 | 14,249 | 69.6% | 68% |

This theory suggests that dark matter is "Almost Matter" spread over multiple dimensions rather than confined to a single well-defined dimension. Thus, without U{139/137} coupling, this dark matter would not be able to interact with photons of energy or have an antimatter counterpart. The dark energy would best be described as expanding remnants of the Big Bang.

The results in Table 4 show an estimate of U{137} composition based on the cumulative property counts for D01 through D10. This represents an arbitrary endpoint that best matches our real-world universe. A more compelling analysis involved calculating the ratios as the FSC Model expands from D01 to D13.

Figure 4 illustrates the running count ratios for the evolution of matter, dark matter, and dark energy as they expand into higher dimensions.

These ratios represent cumulative property counts, starting at D01-D03, D01-D04, and D01-D05 through D01-D13. The math fails at D01 and D02 bleed, but being single values, they match the FSC definitions for matter.

This transition diagram does not represent a timeline but instead a conceptual vision of our universe devoid of space and time. It implies that matter forms first at the low dimensions, then is overwhelmed by dark matter and dark energy at the higher dimensions.

The implication is that lower dimensions represent a chaotic universe, while the higher dimensions reflect a more stable universe where twin prime property sets prevail.

This paradigm envisions how energy was converted to matter after the Big Bang and is still converted to matter inside the chaos of stars. The hotter the environment, the more it favors the creation of matter. This is all very speculative,

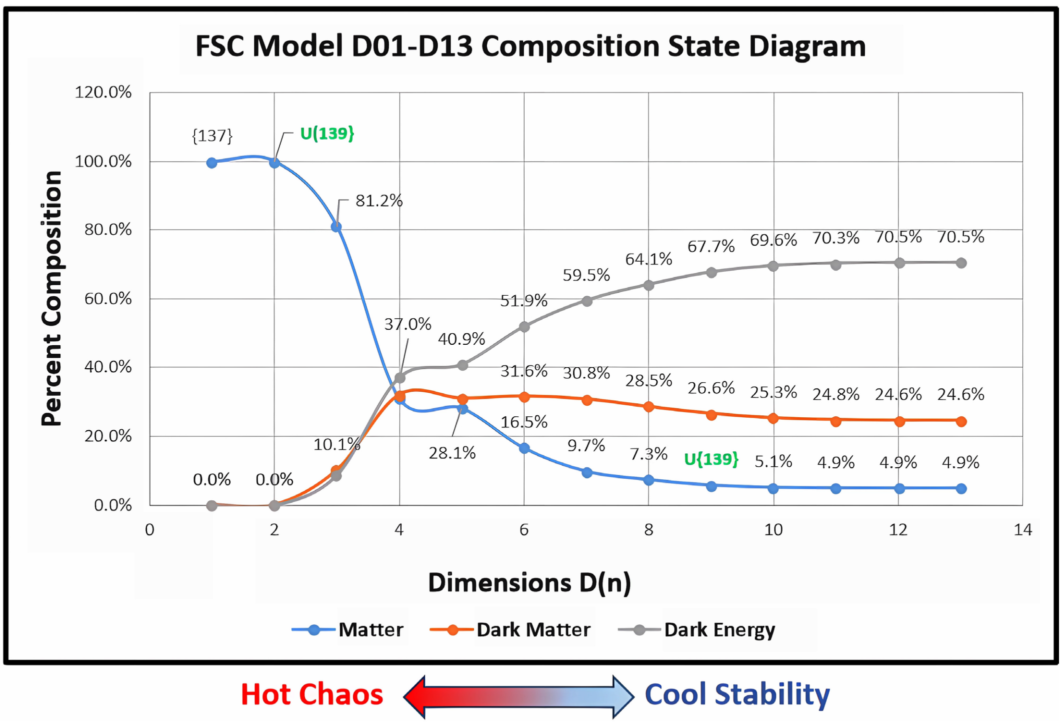



Figure 4. State transition diagram for evolution of matter.

but it demonstrates the ability of the FSC Model to project our thinking into new paradigms of possibilities.

## 6. Conclusions

The FSC Model is a conceptual theory of our universe based on prime number set theory and implied logic. The attempt is to align FSC Model projections to real-world observations, beginning with calculating the Fine Structure Constant ($\alpha$) = 137.036. Objectively, the fact that the FSC Model can replicate the Fine Structure Constant is critically important.

Second, the twin prime orbital model nicely defines the s, p, d, and f-orbitals, and the microverse hierarchy of embedded twin primes aligns with the principal quantum number (n) and the azimuthal quantum number. This all comes together if, in fact, twin prime numbers drive the functionality of the real-world universe.

The prime number model of our universe is best described as a dimensional set of energy packets or quantum fields where matter is formed at high temperatures and stable in cooler conditions. The same transition states can be applied to the early universe, but separated now inside stars, providing the planets with stable environments.

The FSC Model provides a whole number-based conceptual approach for how an elemental quantum system might produce a diverse matter-filled universe and associated physics. It is very much a work in progress but seemingly has the structure and complexity to define a framework for advancing our understanding of our universe.

Finally, 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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