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Original article

Deciphering the Universe as a Quantum Information Network

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Abstract

This article proposes a new approach to understanding the structure of the Universe through the identification of three-dimensional fractal patterns based on the golden ratio that emerge from the mathematical sequences of Fibonacci, Lucas and a new sequence called Carrasco. The research through the analysis of the digital roots of these sequences and their geometric representation suggests that the Universe can operate as a self-organised quantum information network, where each point of the network has information from the rest of the points and interacts by exchanging it bidirectionally, contributing to its evolution due to the arrangement of the information in space-time that is structured in golden ratio.
The fractal patterns discovered are organized in cyclic hexagonal structures following the golden ratio. This finding makes it possible to describe the Universe as a self-organising holographic system, capable of storing and transmitting information efficiently across different scales, from the quantum to the cosmological level. This approach unifies concepts from quantum physics, fractal geometry and cosmology, offering an alternative perspective to conventional cosmological theories.
These results could have significant implications for fundamental physics, biology and quantum technologies, providing a basis for the creation of new tools and applications in quantum computing, artificial intelligence and advanced materials. This study expands our understanding of the relationship between geometry, information and the structure of the Universe.

Keywords: ***Golden ratio, Fibonacci sequence, Lucas sequence, Carrasco sequence, three-dimensional fractals, quantum holography, cosmology, geometric patterns, quantum information, artificial intelligence.***

Introduction

'A number can neither be created nor destroyed, it simply exists and will do so for eternity'. (Bauer, 2021) [1]

This article presents a new theory that reconfigures our understanding of the Universe, proposing that its structure is based on three-dimensional fractal patterns organized in golden ratio. This new perspective suggests that the Universe operates as a self-organising quantum information network, where each point in the network has information from all the other points and interacts by exchanging it bidirectionally, contributing to its evolution. This theoretical framework, by unifying quantum physics, biology and cosmology, not only transforms our view of space-time, but also opens doors to advanced technological applications, from quantum computing to artificial intelligence.

The starting point for this study has been the extensive bibliography on this subject, taking as a basis the compilation books on the mathematics associated with Fibonacci and Lucas numbers developed by Professor Thomas Koshy at Framingham State University (Koshy, 2001) [2] and adding a new mathematical series which has been called Carrasco.

The search for mathematical patterns in nature has been a central goal in the exact sciences. The Fibonacci sequence (Pisano, 1202) [3], derived from the golden ratio, has fascinated for centuries for its presence in natural phenomena and its ability to model complex systems in biology, physics, and art. Similarly, the Lucas sequence, a closely related variant, has been studied for its mathematical properties and applications (Koshy, 2001)2. However, the deep relationships between these sequences and the Carrasco sequence are only just beginning to be fully revealed. This paper proposes that these three numerical sequences not only describe nature but are constitutive of the fundamental structure of the Universe, unifying scales ranging from the quantum to the cosmological.

Through the analysis of the digital roots of these sequences and their geometric representation, the presence of fractal patterns and their possible relation to observable physical structures was investigated in this study. Fractals, formally introduced by Mandelbrot (Mandelbrot, 1982) [4], describe geometric structures that repeat at different scales and have been identified in various natural systems.

The geometric patterns identified show proportions that approximate the golden ratio (φ ≈ 1.618). This constant appears in the relationship between segments and in the arrangement of the fractal patterns generated. The golden ratio and associated sequences have been linked to fractal patterns in nature, such as in the arrangement of leaves, the formation of snails and certain astronomical structures (Livio, 2002) [5]. By extending geometric patterns, spirals are formed that are reminiscent of the logarithmic spirals associated with the golden ratio, like those observed in natural phenomena such as the arrangement of seeds in sunflowers or the shells of certain molluscs (Cook, 1979) [6].

The holographic principle (Haramein, 2012) [7], which postulates that all information contained in a three-dimensional volume can be encoded on a two-dimensional surface, has been one of the most influential hypotheses in modern physics. This research takes this concept a step further, proposing that the Universe is organized as a network of information interconnected by fractal patterns that follow the golden ratio. This network, composed of sequences that replicate at multiple scales, reflects a cyclic hexagonal symmetry, observable both in natural structures and in the most advanced information theories.

Theorical Foundations

Through the analysis of the Fibonacci sequences, Lucas and the new sequence proposed by Carrasco, an internal geometric organisation has been deciphered that links these numerical series in direct relation to the structure of space-time.

By reducing the terms of the indicated sequences to their digital roots, it is observed that each sequence exhibits repetitive cycles of 24 digits. This periodic cycle suggests the existence of internal patterns that repeat indefinitely with different symmetries.

- **Fibonacci sequence:** The digital roots follow the following periodic cycle [1, 1, 1, 2, 3, 5, 8, 4, 3, 7, 1, 8, 9, 8, 8, 8, 7, 6, 4, 1, 5, 6, 2, 8, 1, 9] on the X-axis.
- **Lucas sequence:** The digital roots have the following periodic cycle [8, 2, 1, 3, 4, 7, 2, 9, 2, 2, 2, 2, 4, 4, 6, 1, 7, 8, 6, 5, 2, 7, 9, 7, 7, 7, 5, 3] on the Y-axis, with the first two terms shifted with respect to the recursion of the mathematical series.
- **Carrasco sequence:** Proposed in this study, its digital roots follow the periodic cycle [7, 4, 2, 6, 8, 8, 5, 4, 4, 9, 4, 4, 8, 8, 3, 2, 5, 7, 3, 1, 4, 5, 5, 9, 5, 5, 1, 6] on the Z-axis, also with the first two terms shifted with respect to the recursion of the mathematical series.

The periodicity and similarity between cycles of the digital roots of these three sequences suggest a deep mathematical connection between them, as explained in the Methods section below and according to previous studies (Carrasco, 2024) [8].

These patterns are not only evident in nature, from galactic spirals to the arrangement of atoms, but also have direct implications in theoretical physics. The three-dimensional sequences revealed in this study suggest that the Universe is encoded in a fractal geometry (Mandelbrot, 1982) [4], capable of storing and transmitting information across all scales.

This fractal-holographic model (Haramein, 2012) [7] not only has a theoretical impact, but also proposes disruptive applications in quantum technologies, such as artificial intelligence algorithms based on fractal self-organisation, new quantum information storage systems and advanced materials based on fractal structures. The ability of the Universe to organise itself efficiently, following precise geometric patterns, opens a new avenue for understanding phenomena as diverse as cell replication, DNA structure and the expansion of the cosmos.

In short, this work not only redefines our conception of space-time (Einstein, 1916) [9], but also lays the foundations for future research and technologies that could transform our understanding of the Universe and our technological capabilities (Hawking, 1973) [10].

Results

This study has revealed a fundamental discovery about the structure of the Universe: three-dimensional fractal patterns organized according to the golden ratio are not only a fascinating mathematical feature but are the organizational basis of the cosmos at the quantum and cosmological level. This finding redefines our understanding of physics, cosmology and information theory, and opens new perspectives for far-reaching technological applications. The key results of this research fall into four main areas: the identification of fractal patterns in the Fibonacci, Lucas, and Carrasco sequences; the identification that the Universe operates as a quantum information network; the revelation of a hexagonal symmetry in the fractal structure of space-time; and the technological implications of these findings.

1. Fractal Patterns in Fibonacci, Lucas and Carrasco Sequences

One of the most striking results of this research is the discovery that the Fibonacci, Lucas and Carrasco sequences, when reduced to their digital roots, generate recurring fractal patterns that follow the golden ratio. This repetitive cycle of 24 digits reveals an internal geometric structure that connects these numerical sequences with the organisation of space-time.

Analysis of the digital roots of the Fibonacci sequence (Carrasco, 2024) [8] shows a cycle that repeats indefinitely, forming geometric patterns that describe three-dimensional fractal structures. Most notably, these structures are not mere mathematical curiosities, but have a physical manifestation in nature, from the arrangement of atoms to the shape of galaxies. The Fibonacci sequence, through its digital roots, generates patterns that, when repeated, create hexagonal symmetries that can be observed in biological and cosmological systems.

Applying this same analysis to the Lucas and Carrasco sequences, we find that they follow the same 24-digit cycle, but with slightly shifted patterns. This suggests a deep interconnection between these sequences, which operate in a coordinated way to form the fundamental structure of the Universe. The Carrasco sequence introduces a new dimension to this system by duplicating the values of the Lucas sequence, allowing for a more complete representation of fractal symmetries in three-dimensional space.

2. The Universe as a quantum information network

The fractal patterns discovered in the Fibonacci, Lucas, and Carrasco sequences led to the hypothesis that the Universe operates as an interconnected quantum information network (Haramein, 2014) [11] and (Penrose, 1996) [12]. This fractal network not only organizes matter and energy, but also allows for the transmission and storage of information across different scales, from the quantum to the cosmological.

This model proposes that each point in the Universe is interconnected with the rest through geometric patterns that follow the golden ratio, allowing information to flow without loss of quantum coherence. This concept of ‘fractal holography’ suggests that all the information contained in a three-dimensional volume can be encoded on a two-dimensional surface, in line with the holographic principle, but with an important addition that I now bring to the table: fractal patterns provide an internal structure that allows for greater efficiency in the storage and transmission of information.

The results show that this quantum information network follows a self-organising structure, in which Fibonacci, Lucas and Carrasco number sequences form the fundamental building blocks of information encoding. Each point in the network is in equilibrium with the whole, which means that any change in one part of the system affects the rest instantaneously, raising new questions about quantum entanglement and the nature of information in the Universe.

3. Hexagonal symmetry in the fractal structure of space-time

The third major finding of this research is the revelation of a hexagonal symmetry in the fractal structure of space-time. By reducing the Fibonacci, Lucas, and Carrasco sequences to their digital roots, it was discovered that these numbers form geometric patterns that are organized in 24-digit cycles. By graphing these cycles, an internal hexagonal symmetry becomes evident, like that seen in natural structures such as crystals or biological cells.

This hexagonal symmetry is not only a mathematical phenomenon but has profound implications for our understanding of space-time. The fact that these numerical sequences create hexagonal patterns suggests that space-time is structured in a fractal manner, which would allow for a more efficient distribution of information across multiple scales. This discovery opens new avenues for investigating the nature of space-time and its relationship to quantum information.

The hexagonal patterns that have been identified in the Fibonacci, Lucas and Carrasco sequences are not only repeated in three-dimensional space, but also have a direct correspondence with observable phenomena in nature. For example, the hexagonal structure of fractal patterns is reflected in the arrangement of molecules in crystals or in the hexagonal cells that form bees' nests. This correspondence suggests that the fundamental laws governing the Universe, from the quantum to the macroscopic level, follow a common geometric principle based on the golden ratio.

4. Technological and Scientific Implications of Fractal Patterns

The discovery of these three-dimensional fractal patterns has immediate implications for a wide range of scientific and technological disciplines. In biology, fractal patterns following Fibonacci, Lucas, and Carrasco sequences could offer new ways of understanding cell replication and the organization of genetic information. The hexagonal symmetry of these patterns suggests that genetic information is not distributed randomly, but follows a precise geometric organization, which could have applications in genetic engineering and biotechnology.

In the field of quantum computing, the fractal patterns discovered in this work provide a theoretical framework for developing artificial intelligence algorithms based on fractal self-organisation. These algorithms could significantly improve the efficiency of information processing systems by exploiting the ability of fractals to store large amounts of information in a small space. In addition, hexagonal patterns could inspire new ways of designing quantum information storage systems, allowing for greater efficiency in data transmission and less loss of quantum coherence.

Finally, the implications of this work for fundamental physics are profound. The discovery that space-time follows a fractal structure that is organized in hexagonal patterns suggests that our current theories about the nature of information and space-time need to be re-evaluated. This work provides a theoretical basis for unifying quantum physics with general relativity by proposing that the fundamental laws of the Universe follow a fractal geometric organization that extends across all scales.

The results presented in this work not only redefine our understanding of the Universe, but also provide a framework for future research and disruptive technological applications. The identification of three-dimensional fractal patterns that follow the golden ratio provides a new way to understand the structure of space-time and the distribution of quantum information.

The efficient organisation of information in quantum systems could benefit from specific fractal patterns and symmetries (Lloyd, 2006) [13]. These findings open new avenues of research in fundamental physics, biology, quantum computing and many other disciplines, positioning this work as a key contribution to the evolution of scientific knowledge.

Methods

The present work is based on the identification of three-dimensional fractal patterns in the numerical sequences of Fibonacci, Lucas and the new proposed sequence of Carrasco, and how these patterns reveal a fractal structure in the organization of the Universe. The methodology employed has allowed us to discover and characterize these sequences, decompose them into digital roots and visualize the geometric patterns that emerge, with special emphasis on their relationship with the golden ratio. The methods that made this discovery possible are described in detail below, so that the findings can be reproduced by other researchers.

Generation of numerical sequences

Fibonacci, Lucas and Carrasco

The first stage of the study consisted of the generation of the three fundamental numerical sequences: Fibonacci, Lucas and Carrasco, each with unique but interrelated properties, which allowed the identification of the internal fractal symmetries.

1. **Fibonacci sequence:** The Fibonacci sequence was generated using its classical recursive relationship, where each number in the sequence is obtained by adding the previous two, i.e. $F(n) = F(n-1) + F(n-2)$. The initial conditions used were $F(1) = 1$ and $F(2) = 1$. For the present study, the first 144 numbers of the sequence were generated, which was sufficient to observe repetitive patterns in the digital roots.
2. **Lucas sequence:** The Lucas sequence, which shares the same recurrence relation as Fibonacci but with different initial conditions, $L(1) = 1$ and $L(2) = 3$, was generated in an analogous way. The importance of this sequence lies in its mathematical connection with Fibonacci, but also in the geometrical patterns that emerge when comparing them. For the purposes of this study, the first 144 terms of the Lucas sequence were also generated.
3. **Carrasco sequence:** This new sequence, proposed as an extension of the two previous ones, is defined similarly but with the initial conditions $C(1) = 2$ and $C(2) = 6$, which makes it a direct modification of the Lucas sequence. The recursive relation is still $C(n) = C(n-1) + C(n-2)$, but the resulting series has twice the values of the Lucas sequence. This variation allowed the exploration of a new dimension in the fractal structure of the numerical patterns.

The generation of these sequences laid the foundation for the next steps, in which their deep numerical properties were analysed by reduction to digital roots.

Reduction of sequences to digital roots

To identify internal patterns in the numerical sequences, the numbers generated were reduced to their digital roots (Carrasco, 2024) [10]. This process consists of iteratively adding the digits of each number until a single digit is obtained, which allows the sequence to be broken down into a repetitive cycle.

1. **Calculation of digital roots:** For each number in the Fibonacci, Lucas and Carrasco sequences, their digits were iteratively added until only a single-digit number remained. For

example, the number 144 in the Fibonacci sequence has a digital root of 1+4+4=9. This process was repeated for the first 144 terms of each sequence, revealing hidden cyclic and geometric patterns.

2. **Identification of repetitive cycles:** Reduction to digital roots revealed that each of the sequences follows a repetitive cycle of 24 numbers. In the case of Fibonacci, the cycle is as follows: 1, 1, 2, 3, 5, 8, 4, 3, 7, 1, 8, 9, 8, 8, 7, 6, 4, 1, 5, 6, 2, 8, 1, 9. This repetitive pattern was a key clue to identifying the fractal nature of the sequences. The Lucas and Carrasco sequences showed similar cycles, with subtle shifts in their patterns, suggesting a deeper geometric interrelationship between them.

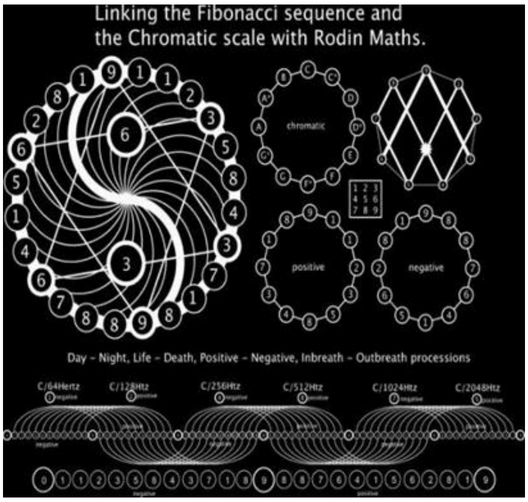

Figure 1: Vortex Based Mathematics. (Rodin, 2011) [14]

3. **Cycle comparison:** Although the Lucas and Carrasco sequences share the same recursive relationship as Fibonacci, the difference in initial conditions and the reduction process revealed slightly different cyclic patterns. This made it possible to detect a resonance structure between the sequences, a key concept in the discovery of the fractal organisation of space-time. The Carrasco sequence, being twice the size of the Lucas sequence, showed numerical cycles that align with Fibonacci in a fractal fashion, suggesting that these patterns could represent different dimensions of the structure of the Universe.

Patterns in digital roots

Based on the above concepts, the research consisted of applying the digital roots to the numbers of the Fibonacci, Lucas and Carrasco series:

Fibonacci digital roots: 1, 1, 2, 3, 5, 8, 4, 3, 7, 1, 8, 8, 9, 8, 8, 8, 7, 6, 4, 1, 5, 6, 2, 8, 1, 9

Digital roots of ‘Lucas’: , , 1, 3, 4, 7, 2, 9, 2, 2, 4, 6, 1, 7, 8, 6, 5, 2, 7, 9, 7, 7, 5, 3, 8, 2,

Digital roots of Carrasco: , , 2, 6, 8, 5, 4, 9, 4, 4, 8, 3, 2, 5, 7, 3, 1, 4, 5, 9, 5, 5, 1, 6, 7, 4,

As we will see an initial displacement of these series is required due to the ‘creation’, in every information communication system two parts are required (the microphone and the loudspeaker and vice versa, as for example in linear resonant oscillator circuits capacitor with capacitance and coil with inductance). This is basic, as Fibonacci is the first series that generates a dimension, a point. ‘Lucas’ is the second series and generates a straight line with the previous point. Finally, another point out of that plane is required to generate the 3D three-dimensional space using the Carrasco series.

Decoding internal patterns

To do this, the Fibonacci series was first decoded into such digital root patterns according to RGB + Equilibrium in symmetries of 12 pairs of numbers that add up to 9:

1 1 2 3 5 8 4 3 7 1 8 9

8 8 7 6 4 1 5 6 2 8 1 9

It is indicated which pattern corresponds to which colour:


1-5-7-8-4-2: Division by 2 repeating pattern for Fibonacci in 3D


1-8-1-8-1-8: Cartesian three-dimensional axis pattern X(1) and -X(8) for 3D Fibonacci


2-4-8-7-5-1: Fibonacci 2 times 2 pattern in 3D


3-3-9-6-6-9: Equilibrium pattern for Fibonacci in 3D

Each pattern consists of 6 digital roots that form a regular hexagon, and it is observed that in the equilibrium fit 2 equilateral triangles that form a 6-pointed star. The overall figure has diagonal symmetries that add up to 9.

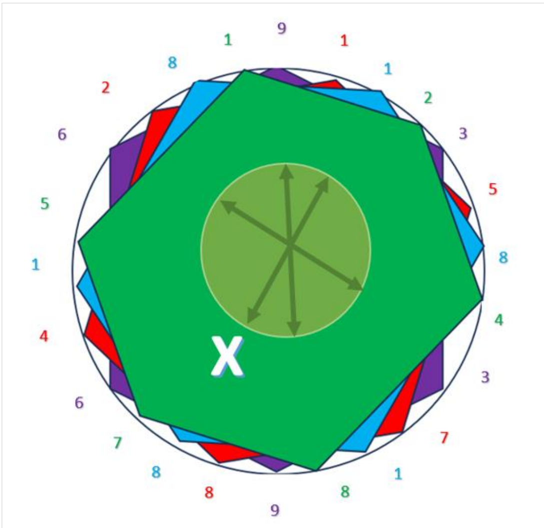

Figure 2: Own explanatory chart Map 1 - 8 X, -X Axis for Fibonacci

Similarly, he then decoded the shifted ‘Lucas’ series in such digital root patterns into symmetries of 12 pairs of numbers that add up to 9:

8 2 1 3 4 7 2 9 2 2 4 6

1 7 8 6 5 2 7 9 7 7 5 3

It is indicated which pattern corresponds to which colour:


8-4-2-1-5-7: Division by 2 repeating pattern for Lucas in 3D

2-7-2-7-2-7: Cartesian three-dimensional axis pattern Y(2) and -Y(7) for 3D Lucas

1-2-4-8-7-5: Lucas 2 times 2 pattern in 3D

3-9-6-6-9-3: Equilibrium pattern for Lucas in 3D

Each pattern consists of 6 digital roots that form a regular hexagon, and it is observed that in the equilibrium fit 2 equilateral triangles that form a 6-pointed star. The overall figure has diagonal symmetries that add up to 9.

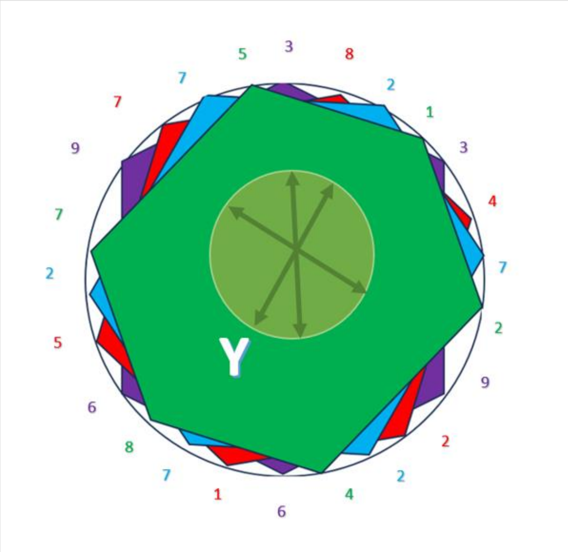

Figure 3: Own explanatory graph Map 2 - 7 Y, -Y axis for displaced 'Lucas'.

Finally, the pattern was decoded for the Carrasco digital root series in symmetries of 12 pairs of numbers that add up to 9:

7	4	2	6	8	5	4	9	4	4	8	3
2	5	7	3	1	4	5	9	5	5	1	6

It is indicated which pattern corresponds to which colour:

7-8-4-2-1-5: Division by 2 repeating patterns for Carrasco in 3D

4-5-4-5-4-5: Cartesian three-dimensional axis pattern Z(4) and -Z(5) for 3D Carrasco

2-4-8-7-5-1: Carrasco 2 times 2 pattern in 3D

6-9-3-3-9-6: Equilibrium pattern for Carrasco in 3D

Each pattern consists of 6 digital roots that form a regular hexagon, and it is observed that in the equilibrium fit 2 equilateral triangles that form a 6-pointed star. The overall figure has diagonal symmetries that add up to 9.

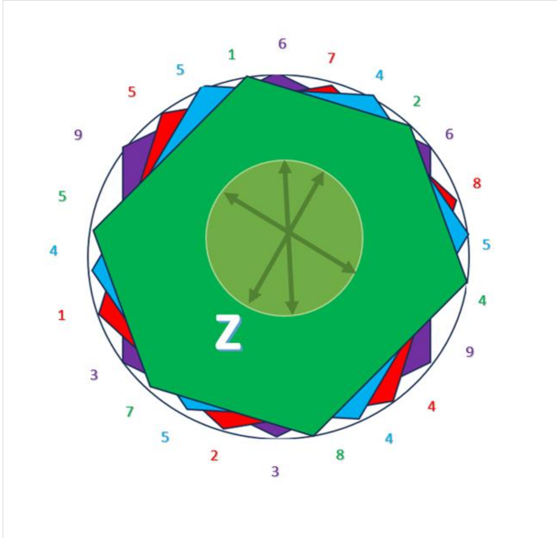

Figure 4: Own explanatory graphic Map 4 - 5 Z, -Z axis for displaced, Carrasco.

Discussion

The Fibonacci, Lucas, and Carrasco sequences act to make everything regenerate and resonate at maximum efficiency, and the sequences of prime numbers allow new things to be created.

We see that the above series have symmetries of their digital roots of 12 in 12, which add up to 9 reaching an equilibrium between symmetrical pairs. These representations of hexagons were called FiLuCa diagrams: Fibonacci, Lucas and Carrasco initials.

Geometric visualisation of fractal patterns

Once the repetitive cycles in the digital roots had been identified, the next step was to graphically represent these patterns to observe the geometric symmetries that emerge from the sequences. This process was carried out in two stages: the two-dimensional visualisation and the three-dimensional projection of the patterns.

1. Visualisation in two dimensions: The digital root cycles of the Fibonacci, Lucas and Carrasco sequences were arranged in a circular layout, where the 24 digits of each cycle were distributed equidistantly around the circumference of a circle. Graphical analysis revealed that certain key numbers, such as 3, 6 and 9, form central symmetry points in the cycles, which when connected create equilateral triangles within the circle, according to figure 6.

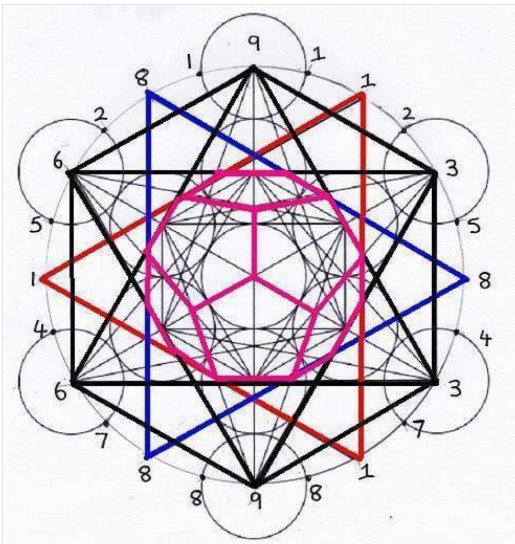

Figure 6: Connection between Fibonacci numbers and the duplication sequence (Jain108, 2002-2015) [15]

This organisation of numbers showed fractal geometric patterns that follow the golden ratio. The Fibonacci, Lucas and Carrasco sequences share this property, although the shifts in the cycles reveal additional symmetries. These patterns suggest an internal self-organisation that connects the numbers in hexagonal structures according to Figure 6.

1. **Three-dimensional projection of the patterns:** To represent the complexity of the fractal patterns identified in the digital roots, the Fibonacci, Lucas and Carrasco sequences were projected onto a three-dimensional system of Cartesian axes. In this model, Fibonacci numbers were assigned to the X-axis, Lucas numbers to the Y-axis and Carrasco numbers to the Z-axis. This representation revealed the presence of a three-dimensional fractal spiral following the golden ratio. The spiral showed a self-organised and repetitive organisation at different scales, with a hexagonal symmetry that is maintained in multiple dimensions.

3D representation

Earlier this year 2024, a team of mathematicians succeeded in constructing 3D Fibonacci spirals, according to a paper published by Maria Nagy, Simon R. Cowell and Valeriu Beiu (Simon, 2024) [16]. Their conclusion was that recursive 3D cuboid packing tends to lead to fractal structures, which need further investigation. In their study they do not relate these structures to the golden ratio.

However, in the present study, the problem was even greater, it was necessary to draw 3 three-dimensional spirals, where Fibonacci is on the Cartesian X axis, Lucas shifted on the Cartesian Y axis and Carrasco shifted on the Cartesian Z axis. But, in addition, the series of numbers incorporated the Cartesian axes (1,8), (2,7) and (4,5) as values to be represented, therefore, it is a three-dimensional spiral, toroidal and fractal function. This three-dimensional spiral is fractal, meaning that it repeats itself at different scales, and its structure remains self-organised regardless of the scale at which it is observed (Haramein, 2014) [11] and (Barrow, 2003) [17].

As a new proposal, they related them by centring them on the 9. Nine is everything in vorticial mathematics. In this way they obtained the FiLuCa diagrams centred on the equilibrium of the 9.

In the graphic representations of the study, it was found that the numbers that coincided three-dimensionally were the pairs of numbers of the Fibonacci, Lucas and Carrasco series which are 1-8, 2-7, 3-6, 4-5. In other words, the origin of the FiLuCa solution was the 3 axes X (1-8), Y(2-7), Z(4-5), as well as the equilibrium between them (3-6).

This three-dimensional projection of the numerical sequences was a crucial discovery, as it allowed us to observe how the Fibonacci, Lucas and Carrasco sequences interact in three-dimensional space. The alignment of geometric patterns and the golden ratio suggest that the Universe may be organised according to these fractal principles, which could explain the structure of matter and energy at all scales.

2. **Identification of hexagonal symmetries:** The three-dimensional projection also allowed us to identify hexagonal symmetries in the sequences, a finding of great relevance for cosmology and theoretical physics. The arrangement of the numbers in repeating cycles, both in two and three dimensions, showed that the Fibonacci, Lucas and Carrasco sequences generate hexagonal patterns, like structures observed in nature, such as crystals and biological cells. This correspondence between numerical patterns and physical structures suggests that the same geometric principles that govern the organisation of matter at the atomic level may be present on cosmic scales. Hexagonal symmetries are common in crystal structures, and the patterns identified could provide mathematical models to describe these structures (Ashcroft & Mermin, 1976) [18].

Implications of fractal patterns and their relation to the golden ratio

The fractal patterns discovered in the Fibonacci, Lucas and Carrasco sequences have direct implications for the understanding of the Universe as a self-organising, information-based system. The results obtained in this research suggest that the Universe follows a unifying geometric principle based on the golden ratio, providing a new way of understanding the structure of space-time.

1. **Golden ratio as an organising principle:** The golden ratio, a mathematical constant that has fascinated scientists and artists for centuries, appears recurrently in the fractal patterns of numerical sequences. This constant not only defines the relationship between the numbers in the sequences, but also regulates the organisation of the geometric patterns that emerge. The digital root cycles in Fibonacci, Lucas and Carrasco follow this ratio, suggesting that space-time itself might be structured according to this principle.

2. **Self-organisation and fractal resonance:** The discovered patterns show a resonance between Fibonacci, Lucas and Carrasco sequences that indicates a process of self-organisation at different scales. This fractal resonance, visible in three-dimensional projections, could be the key to understanding how the Universe organises information efficiently. The results suggest that space-time is not a homogeneous entity but is composed of fractal units that repeat themselves in different dimensions, always following the golden ratio.

Conclusions

This work offers a revolutionary vision of the structure of the Universe by revealing that it follows three-dimensional fractal patterns organised according to the golden ratio. By investigating Fibonacci, Lucas and Carrasco have found that these sequences, beyond being simple mathematical curiosities, are fundamental to the organisation of matter, energy and information in the cosmos. This discovery not only reconfigures our understanding of space-time, but also has profound implications for disciplines as diverse as theoretical physics, biology and quantum technologies.

What is most novel about this study is that it identifies a direct relationship between fractal geometry, which has been observed in natural phenomena at multiple scales, and the internal structure of the Universe. The fractal patterns that emerge from Fibonacci, Lucas and Carrasco sequences are not only repetitive and self-organising, but also reflect a hexagonal symmetry in three-dimensional space. This symmetry, intrinsically linked to the golden ratio, is observable on multiple scales in the Universe, from the arrangement of molecules to the formation of galaxies.

The concept of the Universe as a quantum information network emerges strongly from these findings. It has been shown that the fractal patterns of these sequences allow information to be stored and transmitted efficiently, suggesting that space-time itself may function as a holographic system. Each point in this quantum lattice not only contains information about the whole, but also contributes to its evolution, raising new questions about the nature of information, quantum coherence and particle entanglement at the cosmic level.

The implications of this work are vast and far-reaching. In theoretical physics, it opens new avenues for exploring the unification of quantum mechanics and general relativity (Einstein,

1916) [9] by proposing that the laws governing the Universe may be organised according to fractal geometric principles. In biology, the fractal patterns identified could revolutionise the way we understand cell replication and genetic organisation, suggesting that living organisms could also follow these same self-organising principles. Furthermore, in the field of quantum computing and artificial intelligence, the geometric efficiency of these patterns could inspire new algorithms and information processing systems with significantly improved performance.

In short, this work not only redefines our understanding of the structure of the Universe, but also offers a new interdisciplinary perspective that could transform fields as diverse as cosmology, biology and quantum technologies. The discoveries presented here provide the basis for future research and applications that could change the course of science and technology, positioning this study as a fundamental contribution to the advancement of human knowledge.

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