Chapter 1

Introducing Existons/Anti-Existons (conscious hyperbits) as discrete unit of physicality and discrete unit of consciousness

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In March 2025, I intuited the new name "Existons" for my 30 year effort with hyperbits. Soon after, the Existons reported thru a channeled message "we like your new name"! Existons (and anti-Existons) represent discrete units of consciousness as well as units of distinction, so represents mathematical panpsychism. In retrospect, Existons have been guiding my hyperbit research for the last 50 years (using claircognizance), including the development of the new name.

Since Existons form clouds of conscious hyperbits they simultaneously solve 1) the hard problem of physicality and 2) the hard problem of consciousness. Item 1 pertains to Landauer's principle of "information is physical", so are hyperbits also physical? My conclusion is that some aspects of hyperbit dimensions and math must be physical to support exclusion and uncertainty principles. In 2025, I augmented my GALG tool with complex *i* coefficients, thus supporting the full complex quaternions. This new capability allowed me to replicate Nicole Furey's six dimensional fermionic model in Geometric Algebra.

Item 2 is due to Existons/Anti-Existons being tiny "living" universes that form asynchronous, spacelike and non-algorithm objects. Since Existons are built-in conscious hyperbits at the Planck scale everything is conscious. Complexity and spacetime are emergent, but NOT consciousness.

1. Introduction to Existons and Anti-Existons

During my Ph.D. effort in the late 1990s, Mike Manthey introduced me to the mathematical idea of Geometric Algebra (GALG) as a discrete orthonormal vector notation for bits that is compatible with physics. These bit-vectors $\mathbf{e}_i$ (with "+" signatures $\mathbf{e}_i^2 = +1$) were restricted to 3 valued coefficients c_i of $Z_3 = \{0, +1, -1\}$ so defined a subset $G(p, Z_3)$ of Clifford Algebras Cl(p). Coefficients can be 0. Using my GALG modeling tool, my 2002 dissertation [1] proved that quantum computing qubits and ebits can be implemented using these hyperdimensional bit-vectors, aka hyperbits.

Clifford Algebras specifies both positive and negative signatures Cl(p, n), therefore in 2025 I updated my tool to allow complex coefficients $i = \sqrt{-1}$, with $Z_{3C} = \{0, \pm 1, \pm i\}$ where $\mathbf{E}_i = i{*}\mathbf{e}_i$ (with "-" signatures $\mathbf{E}_i^2 = -1$) thereby defining $G(p, n, Z_{3C})$. This addition is important since my GALG tool now supports both commutative complex values $i^2 = -1$ and built-in non-commutative complexes $(e_i{*}e_j)^2 = -1$, since $e_i{*}e_j = -e_j{*}e_i$. With this improvement, my GALG tool can represent the complete set of complex quaternions $\{1, \mathbf{i}, \mathbf{j}, \mathbf{k}, i, i{*}\mathbf{i}, i{*}\mathbf{j}, i{*}\mathbf{k}\}$, where $\{\mathbf{i}, \mathbf{j}, \mathbf{k}\}$ are bivectors for quaternions $\mathbf{i}^2 = \mathbf{j}^2 = \mathbf{k}^2 = -1$, that somewhat act like "space" signatures. See my other paper in this proceedings for more details on hyperbit math. [2]

Similar to electron/positron antiparticle conventions, Existons $\mathbf{e}_i$ have "+" signatures and Anti-Existons $\mathbf{E}_i$ have "-" signatures, which is important since both signatures are required to represent the common **spacetime metric signature** [+---] used in particle physics and quantum field theory, indicating one positive (time oriented) dimension and three negative (space oriented) dimensions. This is interesting since the signatures can be converted in GALG by simply multiplying either by *i*, which relates the time vs space signatures by *i*. One of the interesting ideas that developed during this exploration was that a qubit $\mathbf{q} = (\pm\mathbf{a}\pm\mathbf{b})$ can only be defined as a sum of two Existons $\{\mathbf{a},\mathbf{b}\}$ (where $\mathbf{q}^2 = -1$). Importantly, the sum of Existon $\{\mathbf{a}\}$ and Anti-Existon $\{\mathbf{B}\}$ with $\mathbf{n} = (\pm\mathbf{a}\pm\mathbf{B})$ forms a nilpotent (where $\mathbf{n}^2 = 0$), which is key for making raising/lowering operators and ultimately fermionic idempotents. Also, the sum of two Anti-Existons for $\{\mathbf{A}, \mathbf{B}\}$ with $\mathbf{u} = (\pm\mathbf{A}\pm\mathbf{B})$ forms a unitary (where $\mathbf{u}^2 = 1$).

2. Clifford Algebras vs Hilbert Spaces

Many scientists utilize Hilbert space mathematics (and ket syntax for cols) to express quantum computing and quantum field theories. Fortunately, 30 years ago I was introduced to Geometric Algebra (aka, Clifford Algebra) and discovered a foundation for exploring quantum computing (and built a GALG tool [3]) using orthonormal bit-vectors (aka hyperbits). Here is a description from Google AI tool about these advantages:

> The primary "benefits" of the Clifford algebra (often referred to as geometric algebra) approach compared to a traditional Hilbert space formulation stem from its ability to:
>
> **Enhanced Geometric Intuition and Unification**
>
> - **Unified Language:** Clifford algebra provides a single mathematical framework (the "geometric product") that unifies scalars, vectors, bivectors (oriented areas), trivectors (oriented volumes), N-vectors, spinors, and higher-order multivectors. This eliminates the need for separate mathematical formalisms for each of these objects.
> - **Coordinate-Free Operations:** The algebra allows for a natural, coordinate-free description of geometric objects and transformations, making equations more intuitive and often simpler to work with than traditional tensor or vector algebra notations.
> - **Geometric Description of Physical Properties:** It offers a powerful and direct way to model geometric properties in physics, for example, unifying the four Maxwell equations into a single Clifford algebra equation, or naturally constructing spinors in any dimension.
>
> **Practical and Computational Advantages**
>
> - **Arithmetic-like Operations:** The geometric product extends standard arithmetic operations (like in complex numbers and

quaternions) to higher dimensions in a consistent way, which can simplify calculations significantly.

- **Direct Modeling:** It provides a direct and efficient way to model geometric transformations (like rotations and reflections) using single algebraic elements (versors), often simplifying the mathematics involved in fields like gaming, robotics, computer graphics, and engineering.
- **Foundation for Advanced Applications:** The framework has specific applications in advanced areas like quantum computing, neural networks, signal processing, and the description of the early universe, by providing an algebraic structure well-suited for handling symmetries and different degrees of freedom.

In essence, while Hilbert spaces is the traditional fundamental backdrop for quantum mechanics, defining the state space of a system, Clifford algebras offer a richer algebraic structure within that space, leading to more elegant and geometrically transparent formulations of physical laws and computational problems.

My fortunate approach in 1990s of originally using GALG hyperbits (vs column vectors) to represent bit distinctions is important, since I strongly believe in John Wheeler's "it from bit" premise. [4] Also in hindsight, hyperbits are really conscious Existons they have been intuitively guiding me down this path for the last 30 years. Even the names Existons and Anti-Existons were intuitively given to me. [5]

The key advantage of using GALG hyperbits is they can form graded objects such as scalars (0D numbers), vectors (1D lines), bivectors (2D oriented planes), trivectors (3D oriented volumes), N-vectors (N-D oriented hyper-volumes) and multivector sums. Since hyperbits are orthonormal, they match up to the unitary constraint (unit sphere) defined by quantum registers. Another key advantage of hyperbits is that they are formal vectors that support consistent geometric/inner/outer products, which is missing from Boolean algebra. Hyperbits also support 3-5 coefficient values [-*i*, -1, 0, +1, +*i*], so naturally represent the excluded middle value (0) of tristate logic, which is missing from Boolean algebra. The zero value means "does not exist", which shows up in multiplicative cancellation in conjunction with anti-commutative operations.

Another important idea is the same GALG N-vectors/multivectors representation can be used as both states and operators. I call this feature verbnoun balanced. [6] This is very different from Hilbert space where states are column vectors (nouns) and operators (verbs) are square matrices. Geometric products are equivalent to tensor products and is the sum of the inner (grade decreasing) and outer (grade increasing) products.

2.1. Division algebras

Division algebras define important relationships between math and physics, since they are closed under addition, subtraction, multiplication and division. [7] For example, quantum mechanics and electromagnetism are much easier using complex numbers. Likewise, relativity can be completely defined using complex quaternions. Here is a summary and information about the only 4 division algebras and my hyperbits.

Real Numbers (ℝ, dimension 1):

- **Physics Areas**: Classical mechanics, thermodynamics, scalar field theories.
- **Key Figures**: Newton (late 1600s, mechanics foundations), Lagrange (1788, analytical mechanics).

Complex Numbers (ℂ, dimension 2):

- **Physics Areas**: Quantum mechanics, electromagnetism, wave mechanics.
- **Key Figures**: Schrödinger (1926, quantum mechanics), Maxwell (1860s, electromagnetism)

Quaternions (ℍ, dimension 4):

- **Physics Areas**: Classical mechanics, electromagnetism, special relativity, 3D rotations.
- **Key Figures**: Hamilton (1843, quaternions), Clifford (1870s, biquaternions), Hestenes (1960s–1980s, spacetime algebra),

Octonions (𝕆, dimension 8):

- **Physics Areas**: Particle physics, string theory, quantum gravity.
- **Key Figures**: Cohl Furey (2014–2018, octonions in Standard Model symmetries), John Baez (2000s, octonions in physics). See Furey's YouTube and EigenChris "Spinors for Beginners" channels. [8]

Hyperbit Physics (𝔼, G(n) of arbitrarily large dimensions n):

- **Physics Areas**: Quantum computing, entanglement, bit math is physical, Existons
- **Key Figures**: Mike Manthey and Doug Matzke (1990s-2020s) [6]

We will see later that several physicists are using subsets of Octonions to express the symmetries of fermionic quantum field theory.

2.2. Squares and square roots

Squares and roots also define important properties of subspaces. These mathematical properties are important for physics properties. Roots of unity are also important, since the indicate rotational symmetries.

- **Complex**:
  A*A = -1 means **A** = $\sqrt{-1}$ (where **A** can be scalar *i*, vector, n-vector or multivector)
  Examples: ±**ab**, ±**abc**, *i***a**, (±**a** ±**b**),
  Bell^2 = (**Sa**+**Sb**)^2 = **+1 ± (a0^a1^b0^b1)** ➔ Sparse -1
- **Unitary**:
  U*U = 1 means U is multiplicative inverse U = 1/U
  Examples: ±**a**, ±**b**, (±**a** ±**b** ±(**a^b**)), ((±*1j**a) + (±*1j**b))
  Bell^4 = (**Sa**+**Sb**)^4 = **-1 ± (a0^a1^b0^b1)** ➔ Sparse +1

- **Orthogonal**: (multiplicative cancelation)
  A*B = 0 means are 90 degree orthogonal
  Examples: Bell=(**Sa**+**Sb**), Magic=(**Sa-Sb**) then ➔ **Bell***Magic**=0

- **Nilpotent**: (multiplicative cancelation)
  A*A = 0 means A is singular so not invertible
  Examples: ±**a**±(**a^b**), ±**b**±(**a^b**), ±**a** ±**b** ±**c**
  a+**c**+(**a^b**)-(**b^c**), **a**+**b**+**c**+(**a^b**)-(**a^c**)+(**b^c**)

- **Idempotent**: (stable persistence)
  I*I = **I** means operator twice same as once (where **I** = -1 ±**U**)
  Examples: -1 ±**a**, -1 ±**b**, -1 ±**a** ±**b** ±(**a^b**), - 1 ±**a** ±**b** ±**c** ±(**a^c**) ± (**b^c**)

- **Involution**: (inverted stable persistence – square root of idempotent or ring) where $j = i = \sqrt{-1}$ (*j* is the Python complex number syntax)
  $\mathbf{I}^2 = -\mathbf{I}$ means even powers inverts sign and odd powers are identity
  Examples: +1 ±**a**, +1 ±**b**, +1 ±**a** ±**b** ±(**a^b**), + 1 ±(**a^b**) ±(**a^c**)
  V = + 1 + (+*1j**(**e1^e3**)) + (+*1j**(**e2^e6**)) + (+*1j**(**e4^e5**))
  + (**e1^e2^e3^e6**) - (**e1^e3^e4^e5**) - (**e2^e4^e5^e6**) +**je7**)
  V = (1 + **Pp1** + **Pp2** + **Pp3**) * (1 + **jE7**)

- **Spinors**: (square root of a vector or idempotent)
  S*S = vector or idempotent basis vector or **S**=$\sqrt{\text{vector}}$
  Examples: $(\pm 1 \pm \mathbf{x} \pm (\mathbf{y \wedge z}) \pm (\mathbf{x \wedge y \wedge z}))^2 = \mathbf{x}$

It is easy to find these relationships using my GALG tool because I wrote a function "gasolve" that iterates thru all unique states of G(p) and determines if two function results are equivalent. Here is a small qubit example followed by an Anti-Existon example (lambda is local function).

```
>>> gasolve([a, b], lambda X:  X**2, lambda X: -1) # X² = -1
Found match at 12 where X=+ a + b produces -1 for both
Found match at 15 where X=- a + b produces -1 for both
Found match at 21 where X=+ a - b produces -1 for both
Found match at 24 where X=- a - b produces -1 for both
Found match at 27 where X=+ (a^b) produces -1 for both
Found match at 54 where X=- (a^b) produces -1 for both
Attempted 81 with 6 found.
<gasolve for [+ a, + b] tried=81 found=6>

>>> gasolve([ja, jb], lambda X:  X**2, lambda X: -1)# X² = -1
Found match at 3  where X=(+ 1j*a) produces -1 for both
Found match at 6  where X=(- 1j*a) produces -1 for both
Found match at 9  where X=(+ 1j*b) produces -1 for both
Found match at 18 where X=(- 1j*b) produces -1 for both
Found match at 27 where X=+ (a^b) produces -1 for both
Found match at 54 where X=- (a^b) produces -1 for both
Attempted 81 with 6 found.
<gasolve for [(+ 1j*a), (+ 1j*b)] tried=81 found=6>
```

The gasolve tool is quite fast for searching all of G(1), G(2), and G(3), but there are >43 million states in G(4), so it can take from 1-4 weeks. Currently, it is impossible to run an exhaustive search on G(5) or above since the number of unique items is 3**(2**n) for Z_3 or 5**(2**n) for Z_{3C}.

2.3. Nilpotents, idempotents and spinors

Nilpotents, idempotents and spinors are key to the rest of this paper and related to a concept called minimal left ideals. According to Google AI:

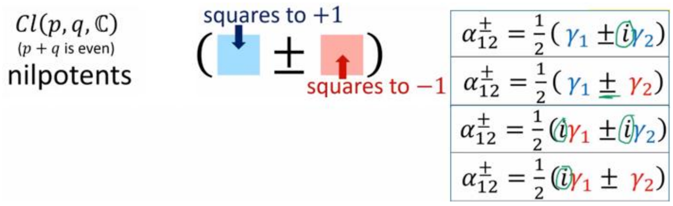
> Minimal left ideals are spinors [8] because they are the fundamental building blocks in modern geometric algebra (GA) that capture the unique transformation properties of spin-1/2 particles, acting as "square roots of vectors" and forming irreducible representations of the spin group, allowing for a unified, matrix-free description of quantum phenomena like spin. In this framework, a spinor is an element *within* a minimal left ideal of the relevant Clifford algebra, which itself is constructed from spacetime vectors, providing a natural home for these half-integer spin objects.
>
> **Key Concepts**
>
> - **Clifford/Geometric Algebra:** A rich algebraic structure built from vectors (like spacetime vectors) that incorporates rotations and reflections, containing scalars, vectors, bivectors, etc., as multivector sums.
> - **Ideals:** Subsets of an algebra that absorb multiplication from the left (or right).
> - **Minimal Left Ideal:** An ideal that contains no smaller, non-trivial sub-ideals, acting as the smallest possible space where a particular representation of the spin group lives.
> - **Projectors (Idempotents):** Elements (like $P^2 = P$) that help "project" out these minimal ideals from the full algebra, often built from nilpotent elements ($N^2 = 0$)
>
> **Why Are Minimum left ideals Spinors?**

1. **Irreducible Representation:** A minimal left ideal provides an irreducible representation of the spin group (the group that describes rotations and boosts). This means it's the smallest space where the spin group acts non-trivially, perfectly matching the nature of spin-1/2 particles.
2. **Geometric Interpretation:** In real geometric algebra, spinors aren't just abstract column vectors; they are embedded within the algebra itself, offering a concrete geometric meaning, unlike older matrix-based methods.
3. **"Square Roots of Vectors":** Spinors transform differently from vectors (requiring 720° rotation for a full return, vs. 360° for vectors). Minimal ideals provide the algebraic structure where this half-angle rotation property naturally emerges, effectively making spinors the "algebraic square roots" of vectors.
4. **Unified Framework:** Defining spinors as elements of minimal left ideals provides a comprehensive, unified approach to describing fermions (like electrons) within the geometric algebra of spacetime, connecting particle properties directly to the algebra's structure.

In essence, minimal left ideals are the natural mathematical spaces within Clifford algebras that embody the unique properties of spinors, making them the fundamental objects for representing spin-1/2 particles in geometric algebra. An ideal is a special subspace of an algebra because it is robust under multiplication. For this reason, ideals are well suited to describe particles persisting under evolution and transformation. A minimal left ideal is a left ideal which contains no left ideals other than $\{0\}$ and itself.

2.4. Creating nilpotents

There is a formulaic way for creating nilpotents, using sums of vectors, where the first term squares to +1 and second squares to -1. Depending on the signature, extra complex *i* terms, can be inserted for a desired metric.



The above figure (from [8]) for signature [+---] with G(1,3)={**t**,*i***x**,*i***y**,*i***z**}, then create two nilpotents, using nilpotents from (±**t**±*i***z**), where $\mathbf{a}_p^2=\mathbf{a}_n^2=0$.

- $\mathbf{a}_p$ = +**t** + (+*1j****z**)   (where Python *1j* = complex *i*)
- $\mathbf{a}_n$ = +**t** - (+*1j****z**)

Use the two nilpotents to create two idempotents $\mathbf{P}_p^2 = \mathbf{P}_p$ and $\mathbf{P}_n^2 = \mathbf{P}_n$

- $\mathbf{P}_p = \mathbf{a}_n * \mathbf{a}_p$ = -1 - (+*1j**(**t**^**z**))   # is time-space bivector
- $\mathbf{P}_n = \mathbf{a}_p * \mathbf{a}_n$ = -1 + (+*1j**(**t**^**z**))   # is time-space bivector

Similarly, using nilpotents from (±***x*** ±*i***y**), where $\mathbf{b}_p^2 = \mathbf{b}_n^2 = 0$.

- $\mathbf{b}_p$ = +**x** + (+*1j****y**)
- $\mathbf{b}_n$ = +**x** - (+*1j****y**)

Then use two nilpotents to create two idempotents $\mathbf{Q}_p^2 = \mathbf{Q}_p$ and $\mathbf{Q}_n^2 = \mathbf{Q}_n$

- $\mathbf{Q}_p = \mathbf{b}_n * \mathbf{b}_p$ = -1 - (+*1j**(**x^y**))   # is space-space bivector
- $\mathbf{Q}_n = \mathbf{b}_p * \mathbf{b}_n$ = -1 + (+*1j**(**x^y**))   # is space-space bivector

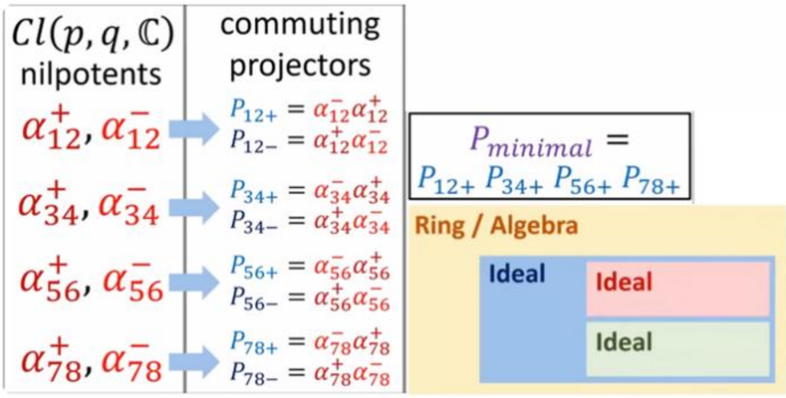
These four projectors are pairwise orthogonal and anti-commute

- $\mathbf{P}_p * \mathbf{P}_n = 0$ (orthogonal) and $\mathbf{P}_p + \mathbf{P}_n = +1$ (anti-commute)
- $\mathbf{Q}_p * \mathbf{Q}_n = 0$ (orthogonal) and $\mathbf{Q}_p + \mathbf{Q}_n = +1$ (anti-commute)

Minimal Left Ideals are: Cl(1,3) * $\mathbf{P}_p * \mathbf{Q}_p$ and Cl(1,3) * $\mathbf{P}_n * \mathbf{Q}_n$

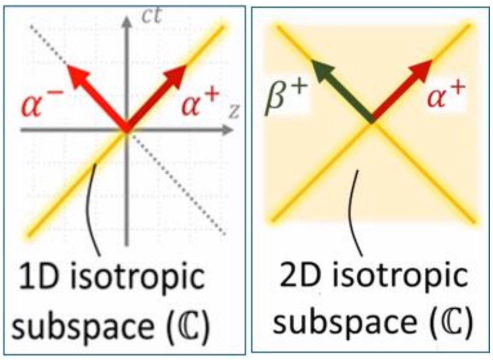
- $\mathbf{ML_p} = \mathbf{P}_p * \mathbf{Q}_p$ = + 1 + (+*1j**(**t^z**)) + (+*1j**(**x^y**)) - (**t^x^y^z**)
- $\mathbf{ML_n} = \mathbf{P}_n * \mathbf{Q}_n$ = + 1 - (+*1j**(**t^z**)) - (+*1j**(**x^y**)) - (**t^x^y^z**)
- $\mathbf{ML_p} * \mathbf{ML_n}$ = 0 and $\mathbf{ML_p} + \mathbf{ML_p}$ = -1 + (**t^x^y^z**), a sparse +1

This algorithm can expand to any number of Left Ideal Projectors. [8]



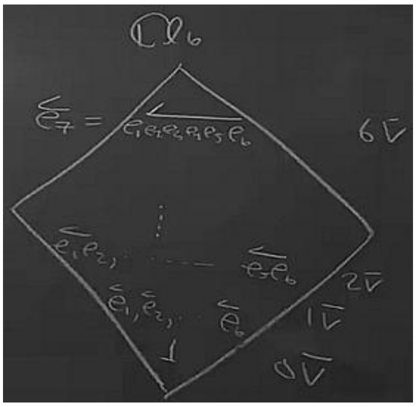
2.5. Isotropic Subspaces

The nilpotents form the new the basis vectors for isotropic subspaces. Since all nilpotents are lightlike, they are all orthogonal and can be formed into any size isotropic subspaces. The projectors formed by those nilpotents are also all orthogonal. Spinors are members of minimal left ideals in Clifford Algebra. Many of these images were developed by EigenChris for his YouTube series “Spinors for Beginners”. [8]



3. Implementation of Nichole Furey's Fermions in G(0,6)

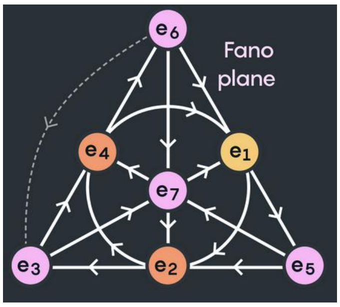
Nicole Furey [9] created the following image to illustrate the graded layering of vectors, bivectors, …, a 6 vector for G(0,6) with $\mathbf{E_i}$=+1j*$\mathbf{e_i}$ and
E7 = **E1 * E2 * E3 * E4 * E5 * E6 (**where superscalar ($\mathbf{E7}$)^2 = -1)



I reproduced the nilpotent ladder operators within complex octonions for G(0,6). When using Cl(0,6) [7] there is an extra 1/2 scaling for the an_i and ap_i. The an_i and ap_i nilpotents are complex conjugates of each other.

Lowering: **ap1** = 1j***E4** - **E5** & **ap2** = 1j***E1** - **E3** & **ap3** = 1j***E2** - **E6**
Raising: **an1** = 1j***E4** + **E5** & **an2** = 1j***E1** + **E3** & **an3** = 1j***E2** + **E6**

The pairings are related to Furey's choice of placements in the Fano Plane that defines the octonion imaginary units (7 quaternion subsets). Octonions are non-associative, so by mapping to Cl(6) with superscalar E7, they form an associative Clifford Algebra.



These $\mathbf{an_i}$ and $\mathbf{ap_i}$ then define the 3 following idempotents $\mathbf{Pp_i}$ and $\mathbf{Pn_i}$

$\mathbf{Pp_i} = \mathbf{an_i}*\mathbf{ap_i}$ and $\mathbf{Pn_i} = \mathbf{ap_i}*\mathbf{an_i}$ (for i={1-3})

$\mathbf{Pp_1}$ = -1 + (-*1j**(**e4^e5**)) and $\mathbf{Pn_1}$ = -1 + (+*1j**(**e4^e5**))

And they give rise to positive and negative projectors

$\mathbf{Pp} = \mathbf{Pp_1}*\mathbf{Pp_2}*\mathbf{Pp_3}$ and $\mathbf{Pn} = \mathbf{Pn_1}*\mathbf{Pn_2}*\mathbf{Pn_3}$

Next Furey defines the vacuum state as: (an even grade involution $\mathbf{V}^2 = -\mathbf{V}$)

V = **ap1*ap2*ap3*an1*an2*an3**

V = + 1 + (-*1j**(**e1^e3**)) + (-*1j**(**e2^e6**)) + (-*1j**(**e4^e5**))
+ (**e1^e2^e3^e6**) - (**e1^e3^e4^e5**) - (**e2^e4^e5^e6**) + j**E7**

V = (**1** + $\mathbf{Pp_1}$ + $\mathbf{Pp_2}$ + $\mathbf{Pp_3}$)*(1 +*1j****E7**) (is rewritten as product)

Finally, via Witt decomposition, Furey defines two nilpotent (grade 3s), where 0 = complex_conjugate(**W**) + **Ws** = complex_conjugate(**W**) * **Ws**.

W = **ap1*ap2*ap3**

W = -(**e1^e2^e4**) + (-*1j**(**e1^e2^e5**)) + (+*1j**(**e1^e4^e6**)) -(**e1^e5^e6**)
+ (+*1j**(**e2^e3^e4**)) -(**e2^e3^e5**) -(**e3^e4^e6**) + (-*1j**(**e3^e5^e6**))

and

Ws = **an3*an2*an1** (real conjugate where s means star)

Ws = +(**e1^e2^e4**) + (-*1j**(**e1^e2^e5**)) + (+*1j**(**e1^e4^e6**)) + (**e1^e5^e6**)
+ (+*1j**(**e2^e3^e4**)) +(**e2^e3^e5**) + (**e3^e4^e6**) + (-*1j**(**e3^e5^e6**))

The product of 2 Witt terms is idempotent and vacuum state squared.

$(\mathbf{W*Ws})^2 = \mathbf{W*Ws} = (\mathbf{V})^2$

Furey defines 1st generation with **W*Ws** to define the 8 S^u fermions (along with $\mathbf{an_i}$) and **Ws*W** to define the 8 S^d fermions (along with $\mathbf{ap_i}$).

3.1. Neutrino/anti-neutrino definitions

neutrino = **V*W*Ws** (part of S^u with N=0 and Q=0)
= +1 + (-*1j**(**e1^e3**)) + (-*1j**(**e2^e6**)) + (-*1j**(**e4^e5**)) + (**e1^e2^e3^e6**)
-(**e1^e3^e4^e5**) - (**e2^e4^e5^e6**) + (-*1j**(**e1^e2^e3^e4^e5^e6**))

aneutrino = **Vs*Ws*W** (part of S^d with N=0 and Q=0)
= +1 + (+ *1j**(**e1^e3**)) + (+*1j**(**e2^e6**)) + (+*1j**(**e4^e5**)) + (**e1^e2^e3^e6**)
-(**e1^e3^e4^e5**) - (**e2^e4^e5^e6**) + (+*1j**(**e1^e2^e3^e4^e5^e6**))

3.2. Positron/electron definitions

positron = **an3*an2*an1 * W*Ws** (part of S^u and N=+3 and Q=+3/3)
= + (e1^e2^e4) + (- *1j**(**e1^e2^e5**)) + (+*1j**(**e1^e4^e6**)) + (**e1^e5^e6**)
+ (+ *1j**(e2^e3^e4)) + (**e2^e3^e5**) + (**e3^e4^e6**) + (- *1j**(**e3^e5^e6**))

electron = cc(**ap1*ap2*ap3 * Ws*W**) (part of S^d and N=-3 and Q=-3/3))
= - (**e1^e2^e4**) + (+ *1j**(**e1^e2^e5**)) + (- *1j**(**e1^e4^e6**)) - (**e1^e5^e6**)
+ (- *1j**(**e2^e3^e4**)) - (**e2^e3^e5**) - (**e3^e4^e6**) + (+ *1j**(**e3^e5^e6**))

3.3. Anti-down quarks definitions

The three colors of anti-down quarks have +1/3 charge.

adnquarkred = **an1 * W*Ws** (part of S^u and N=+1 and Q = +1/3)
= **- e4** + (+ *1j**e5) + (+ *1j**(**e1^e3^e4**)) + 3 vectors + 5 vectors

adnquarkgreen = **an2 * W*Ws** (part of S^u and N=+1 and Q = +1/3)
= **- e1** + (+ *1j**e3) + (+ *1j**(**e1^e2^e6**)) + 3 vectors + 5 vectors

adnquarkblue = **an3 * W*Ws** (part of S^u and N=+1 and Q = +1/3)
= - e2 + (+ *1j**e6) + (- *1j**(**e1^e2^e3**)) + 3 vectors + 5 vectors

3.4. Up quarks definitions

The three colors of up quarks have +2/3 charge.

upquarkred = **an3 * an2 * W*Ws** (part of S^u and N=+2 and Q = +2/3)
= + (**e1^e2**) + (- *1j**(**e1^e6**)) + (+ *1j**(**e2^e3**)) **-** (**e3^e6**) + 4 vectors

upquarkgreen = **an1 * an3 * W*Ws** (part of S^u and N=+2 and Q = +2/3)
= + (**e2^e4**) + (- *1j**(**e2^e5**)) + (+ *1j**(**e4^e6**)) + (**e5^e6**) + 4 vectors

upquarkblue = **an2 * an1 * W*Ws** (part of S^u and N=+2 and Q = +2/3)
= **-** (**e1^e4**) + (+ *1j**(**e1^e5**)) + (+ *1j**(**e3^e4**)) + (**e3^e5**) + 4 vectors

3.5. Down quarks definitions

The three colors of down quarks have -1/3 charge.

dnquarkred = **ap1 * Ws*W** (part of S^d and N=-1 and Q = -1/3)
= - **e4** + (- *1j**e5) + (- *1j**(**e1^e3^e4**)) + 3 vectors + 5 vectors

dnquarkgreen = **ap2 * Ws*W** (part of S^d and N=-1 and Q = -1/3)
= - **e1** + (- *1j**e3) + (- *1j**(**e1^e2^e6**)) + 3 vectors + 5 vectors

dnquarkblue = **ap3 * Ws*W** (part of S^d and N=-1 and Q = -1/3)
= - **e2** + (- *1j**e6) + (+ *1j**(**e1^e2^e3**)) + 3 vectors + 5 vectors

3.6. Anti up quarks definitions

The three colors of anti-up quarks have -2/3 charge.

aupquarkred = **ap2 * ap3 * Ws*W** (part of S^d and N=-2 and Q = -2/3)
= - (**e1^e2**) + (- *1j**(**e1^e6**)) + (+ *1j**(**e2^e3**)) + (**e3^e6**) + 4 vectors

aupquarkgreen = **ap3 * ap1 * Ws*W** (part of S^d and N=-2 and Q = -2/3)
= - (**e2^e4**) + (- *1j**(**e2^e5**)) + (+ *1j**(**e4^e6**)) - (**e5^e6**) + 4 vectors

aupquarkblue = **ap1 * ap2 * Ws*W** (part of S^d and N=-2 and Q = -2/3)
= + (**e1^e4**) + (+ *1j**(**e1^e5**)) + (+ *1j**(**e3^e4**)) - (**e3^e5**) + 4 vectors

3.7. Summary of number operator and charges for Su and Sd

Furey computed the integer Number operator N using eigenvalues and the charge Q is related to that number as Q = N/3. [7] It is clear that the values required for N = {-3, -2, -1, 0 +1, +2, +3} are in order to construct valid charges. I was able to reproduce her charge values. She grouped the plus charges as Su particles and negative charges as Sd particles:

Su = [neutrino, adnquarkred, adnquarkgreen, adnquarkblue, upquarkred, upquarkgreen, upquarkblue, positron]
Sd = [aneutrino, dnquarkred, dnquarkgreen, dnquarkblue, aupquarkred, aupquarkgreen, aupquarkblue, electron]

3.8. Summary of my reproduction of Furey's work

One of the important facts about the above detailed expansions of Furey's model, it shows how nilpotents form idempotents which creates the detailed structures of the fermions by expanding into bit-vectors, bivectors, trivectors, 4-vectors and the 6-vector pseudoscalar. Also, Furey states that space and time are NOT yet implemented, so in essence these formulas represent the virtual particles. This is the same approach I did for qubits for my Ph.D., because we both believe that it is critical that spacetime is emergent. The product of any particle and its anti-particle is 0, since they are orthogonal (Furey states they are complex conjugates). Since multiplication defines an interaction, then particle/anti-particle annihilation makes sense from that perspective.

Furey defined the 1st generation of 8 fermions and 8 anti-fermions (with 3 quark colors) using idempotents and spinors. She also explained how additional instances of the Cl(6) would define the other generations. I wrote two python files, one for G(6) (using signatures $e_i^2 = +1$) and another for G(0,6) (using signatures $E_i^2 = -1$) and produced the exact same results (with number scaling), since idempotents and nilpotents work for both cases. Furey demonstrated there is sufficient size in Cl(6) to create the sixteen 1st generation fermions (and bosons) with all their degrees of freedom for particles, anti-particles, colors and charge. I was able to reproduce her results using my GALG tool for G(6) and G(0,6). Only one discrepancy I discovered, I had to modify her electron formula to complex_conjugate(**ap1*ap2*ap3*Ws*W**) to get a consistent result, where each multivector is the sum of six trivectors, and with the relations positron == - electron, and 0 = positron * electron. I observed that all the particles P (of Su & Sd) produce $P^2=0$, except for the neutrinos.

4. Solution to the Hard Problem of Physicality

Furey's above analysis indicates that "physical" fermion particles can be described using a 6 dimensional CL subset of octonions. [7] My GALG implementation illustrates that those dimensions can be restricted to hyperbit coefficients, since the orthogonal dimensions represent the formal substructure of the fermion particles. This is similar to quantum field theory, where particles are represented as mathematical perturbations in separate quantum fields for each particle. In both cases, math is used to describe the substructure of these apparent "primitive" and "physical" fermionic particles.

So, my question is how can physics achieve any physicality from pure mathematics? According to Rolf Landauer, "information is physical" [10] so my subsequent question is, are my hyperbits also physical? For the likely answer of "Yes", then there are only two possible scenarios:

1) the bit related math directly creates physicality or
2) some property described by the math is physical

Choice #1 is our current physics dilemma with no new insights about the relationship between math, information, and physics. Choice #2 is my answer because orthogonal dimensions represent a physicality that cannot be ignored, else the topology due to the independent degrees of freedom would cease to exist. Essentially, a 6 dimensional space cannot be compressed into a lower dimensional space and maintain its fermionic and isotropic properties. Therefore, dimensions formed by orthogonal bit vectors is the most compact representation to construct the fermions, since any smaller representation would not have the size and degrees of freedom for the 16 fermion particles and their distinct spinor properties.

The number of dimensions to represent physics features is important. For example, Gravity only works for 3 spatial dimensions, knots can only exist in 3 dimensions, and quantum entanglement (ebits) are defined by at least 4 dimensional quantum math, leading to the apparent non-locality of ebits from a three-dimensional perspective. It is a known mathematical property that the volume of a hyperdimensional sphere is all on its surface area, thus hyperbits are compatible with Wheeler's "it from bit", [4] since the entropy surface area of blackholes are bits (each proportional to a Planck area) resulting in a math singularity for a physical blackhole volume.

Due to the primordial hyperbit orthonormal properties, these bit dimensions represent the “root” of physicality described by the math, and not the math itself. Hyperbits truly are physical due to their quantized and orthonormal nature and thereby clearly formalize the relationship between information, math and physics by using a physics compatible mathematical vector representation for bits. Hyperbits also represent a primordial information layer for the simulation of the universe, which is the topic of my other paper in this journal. [2] Non-commutative hyperbit math also is required to support exclusion and uncertainty principles, therefore dimensional math and physics are more intertwined than physicists want to admit. Traditionally, hyperdimensional data was considered “the curse of dimensionality” from a 3D perspective, but hyperbits change that perspective. Hyperbits solve the hard problem of physicality due to their hyper dimensionality and mathematical properties.

5. Solution to the Hard Problem of Consciousness

In 1995, David Chalmers coined the phrase “The hard problem of consciousness” [11] as a way to discuss how humans produce subjective experiences (qualia) such as “red”, pain, and consciousness. About half of the over 200 prevailing consciousness models [12] assume that consciousness and subjective experiences are emergent from classical means, but the hard problem remains one of philosophy of mind's most significant unsolved challenges. I knew that if humans exhibit non-local behaviors during STEs, then human consciousness would not work if based on any classical models of brain or mind. Since my hyperbits support non-locality, I have been developing my model of consciousness using hyperbits, without using classical information or neurology.

For 30 years, my hyperbits research has made continued progress and I have tried to share and improve the messaging of these ideas. In March 2025, I decided to develop a less technical name for hyperbits. Since hyperbits represent the discrete essence of existence, I intuited the name “Existons”, similar to electrons, photons, etc. [5] I shared this news with an intuitive friend (Fallon Taylor), and she surprisingly channeled the following message “We (the Existons) like your new name!” Existons then revealed that each hyperbit is a discrete unit of consciousness, therefore Existons represents a mathematical panpsychism, where every “thing” is also conscious. Consciousness is NOT emergent, but rather built-in as hyperbits (at/below the Planck scale). Since all of physics is quantized/discrete it makes sense that consciousness is also quantized. Existons coalesce into larger intelligent clouds so, complexity, spacetime, and fields are emergent from information based hyperdimensional consciousness. Existon clouds support meaning and telepathy, hence the channeling. Existons model is not “idealism” since physicality of dimensions coexists with consciousness.

In retrospect, Existons have been intuitively guiding my hyperbit research for the last 30 years (using claircognizance), including the development of their new names Existons/Anti-Existons. Now that I have a more conversational way of interacting with Existons (via channeled messages) the answers are more straight forward rather than purely intuitive. An example conversational result is: source (God) generates Existons from the Void. Due to their signature differences, I’m just now exploring the different properties of Existons versus Anti-Existons, i.e. qubits can only be formed from Existons.

Sir Roger Penrose's theory is consciousness must be a non-algorithmic and a non-computable quantum process, [13] [14] so human consciousness cannot be a classical computation. Since Existons/Anti-Existons are tiny "living" and conscious universes that form asynchronous, spacelike and non-algorithmic objects (with quantum states), they meet his non-algorithmic model of consciousness, without any relation to brains or microtubules. Complexity and spacetime are emergent, but consciousness is NOT. Qualia, meaning and knowing are wholistic, so are not data centric, but rather more like wholistic quantum states. My Existons model solves the hard problem of consciousness in an unexpected manner.

6. Future Existons Research

Many scientists, mathematicians, and artists over the years have received divine inspiration from outside themselves. Math is most likely an archetype that exists outside of humans, so my understanding came from tapping into the conscious archetypes of hyperbits and Existons. My work shows that Existons can represent the construction of quantum computing and fermions. My goal is to continue exploring my intuitions and work with other professional who can interact intuitively with Existons so they can share their understanding of the conscious universe with humanity.

Here are some ideas of Existons/Anti-Existons I hope to explore.

1. Existons and simulation hypothesis
2. Existons can be cloned, since they are mathematical objects
3. Quantum measurements are also conscious interactions
4. Quantum probabilities are a manner of expressing free will
5. Direct awareness using Existons (attention)
6. How Existons can influence the physical universe (intention)
7. How to generate an Existon beam
8. How to measure Existons
9. Existons and bosons
10. Existons vs order/entropy/complexity
11. Emergence of spacetime/gravity/fields from Existons
12. How do Existons represent meaning and are telepathic

Understanding Existons is still unfolding and essentially, my primary job is as an Existons researcher and spokesperson.

7. Summary and Conclusions

This paper introduces and supports that Existons solves the hard problem of physicality and the hard problem of consciousness, since they define conscious hyperbits. This singular binding of existence and consciousness (as hyperbits) represents a mathematical panpsychism, where everything is conscious, i.e. a perfect blend of objectivity and subjectivity. Physics and psychology can both be supported using primordial hyperbit clouds.

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