Space-Like Computations

on

Computing Machines

Michael Manthey

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Abstract: Space-like computation - the complement to Turing's time-like computation - is inherently distributed, self-organizing, and capable of multi-level awareness [aka. consciousness]. ... Includes an Appendix with the essential source code.

The paradigm has the structure

$$U(1) \times SU(2) \times SU(3) \times SO(4),$$

using geometric (Clifford) algebra over $Z_3 = \{0, 1, -1\}$.

Extracted from the USPTO application of 2015.

The patent issued on May 26, 2020.

The invention targets the construction of logically distributed computational systems, and solves this widely researched but hitherto unsolved problem.

It implements the Universal Wave Function of quantum mechanics in computer code, based on the concept of the co-occurrence of arbitrary events.

A simple example (the Coin Demo) shows that co-occurring events contain *information that conventional computers cannot access*, limited to sequentiality by the theorems of Alan Turing.

This same approach offers inherent and logarithmically efficient self-organization [based on 'experience in the world'] and will at some modest complexity level exhibit undeniable awareness.

There is NO numerical computation whatsoever
because the 'data' is synchronization patterns.
And NO physics ... ***it's pure combinatorics.***
yet system semantics satisfy

$$U(1) \times SU(2) \times SU(3) \times SO(4)$$

Applications: *all* natural and built systems.

The actual run-time structure that produces all behavior is built entirely out of **synchronization** [wait/signal] **tokens** in the form of tuples in a shared global tuple space ... this is the "data".

Obvious immediate applications: Internet of Things (IoT) and funds transfer systems (no 'mining' necessary), but these are just the tip of the iceberg - the patent will be the foundation of all computing, and a lot more, in the coming decades.

__Awareness__ is a complex adaptive __self-preserving__ __resonance__. One 4-tier [later] is enough. __Consciousness__ is awareness of awareness, and uses two 4-tiers. The frequencies & amplitudes in a tier's surround determine its particular properties.

Geometric (Clifford) Algebra G_n

multi-dimensional

    graded

        "coordinate free"

            vector algebra

$a, b, ..., ab, ..., abc, ..., abcd, ...$ are mutually $\perp$

multiplication $= 90^o$ rotation

anti-commutative: $ab = -ba$

Here: over $\mathbb{Z}_3 = \{0, 1, 2\} = \{0, 1, -1\}$

Zero = **Void**   **{1,-1} are opposites.**

Parseval's Identity: The projection of an n-dimensional function F onto an n-dimensional vector space **is** the Fourier decomposition of F.

So we're in a phase space ... **wave world**.

The phases are phases of synchronization: *go/nogo*, ie. signal/wait.
The tuples in the code are tokens indicating this.

There's No Place Like Space

Quaternion triples - representations of 3-space
$$XY = Z, \quad YZ = X, \quad ZX = Y,$$
$$XYZ = -ZYX$$

SU(2) $\qquad\qquad G_3 = \{a, b, c\}$
Classic 3d: $X = ab, \quad Y = bc, \quad Z = ca,$
$X, Y, Z \Rightarrow abc = $ 3d volume;
$-abc(ab + bc + ca) = a + b + c = $ *photon*

SO(4) $\qquad\qquad G_4 = \{a, b, c, d\}$
TauQuernions:
$$X = ab - cd, \; Y = ac + bd, \; Z = bc - ad;$$
" -1 " $= 1 + abcd$;
paired disjoint mutually orthogonal planes
nilpotent Higgs boson $(X + Y + Z)^2 = 0$
houses *3+1d relativistic spacetime*

SU(3) $\qquad\qquad G_5 = \{a, b, c, d, e\}$
TauQuinions:
$$X = ab - cde, \quad Y = ac + bde, \quad Z = bc - ade$$
" -1 " $= 1 + abcde$
paired disjoint mutually orthogonal plane+volume
houses *electro-magnetism*

Building Hierarchy

The boundary $a, b, c, d, e, ...$ is given, but

Where do $ab, abc, abcd, abcde$ come from?

$$a + b \xrightarrow{\delta} ab \qquad ab \text{ is the 'atom' of } spin$$

δ is the geometric version of integration $\int$

Apply **co-exclusion**: $(a + \tilde{b})|(\tilde{a} + b) \Rightarrow ab$.
$$(a + b)|(\tilde{a} + \tilde{b}) \Rightarrow ab$$

So "the hierarchy" is the that of the calculus.

δ is the source of emergent behavior.

∂ is the opposite of δ, defined as the eigen form:

$$\partial_Q(X + Y) = X' + Y'$$

So build another level of hierarchy:

$$c + ab \xrightarrow{\delta} abc \qquad\qquad abc \text{ is the "atom" of } charge$$

$$\qquad\qquad\qquad\qquad lhs \text{ is a boundary } \partial \text{ of } abc$$

$$a + b \xrightarrow{\delta} ab$$

And another:

$$ab + cd \xrightarrow{\delta} abcd \qquad abcd = \text{"atom" of mass/space}$$

$$\qquad\qquad\qquad\qquad ab + cd \text{ is } \textbf{\textit{irreversible}}$$

$$c + ab \xrightarrow{\delta} abc$$

$$a + b \xrightarrow{\delta} ab$$

And another:

$$ab + cde \xrightarrow{\delta} abcde \qquad\qquad ab + cde \text{ is } \textbf{\textit{irreversible}}$$

$$ab + cd \xrightarrow{\delta} abcd \qquad\qquad (\text{also } a + bcd \xrightarrow{\delta} abcd)$$

$$c + ab \xrightarrow{\delta} abc$$

$$a + b \xrightarrow{\delta} ab$$

__Includes __all__ singletons & 2-sums__ $\binom{n}{i+j}$*__, __*$n, i+j \leq 5$
__1, 2, 3, 4, 5,__
__1+1, 1+2, 2+2, 1+3, 2+3, 3+3__

By the Way

TauQuernions and TauQuinions are also
entanglement operators

eg.

$(a + b)(c + d) = ac + ad + bc + bd$, **but**

$(ab + cd)(a + b)(c + d) = ac - bd$

The previously distinct $(a + b)$ and $(c + d)$
become "*non-separable*" in $ac - bd$.

Also, irreversible due to loss of phase information.

About the algebra's pseudo-scalars

a	ab	abc	$abcd$	$abcde, \ldots$	
a^2	$(ab)^2$	$(abc)^2$	$(abcd)^2$	$(abcde)^2 \ldots$	
$+1$	-1	-1	$+1$	$+1$	$-1 \ldots$

The $+$ - - $++$ - - indicates powers of $i = \sqrt{-1}$!

The semantics repeat in a 4-cycle.
So the hierarchy consists of tiers of 4.

Like this:

$\vdots$

$\vdots$

3+3=6 mod4=2
2+3=5 mod4=1   4-tier

2+2=4 mod4=0   map to 1   new
1+3=4 mod4=0   map to 1   Begin
1+2=3
1+1=2

So what do we have?

4. SO(4) TauQuernions $\quad ab + cd \xrightarrow{\delta} abcd \quad$ ‡

3. SU(3) TauQuinions $\quad ab + cde \xrightarrow{\delta} abcde \quad$ ‡

2. SU(2) Quaternions $\quad c + ab \xrightarrow{\delta} abc$

1. U(1) Circle group $\quad a + b \xrightarrow{\delta} ab$

‡ Entanglement operators

–

Everything is geometric, ie. space-like!

4. mass & gravity (= love)
3. electricity
2. magnetism
1. existence

Inherently factors boundary inputs into these four categories of interaction.

Stackable tiers. Constructive. Discrete. Finite but Unbounded. Non-reductive. Non-deterministic. Non-material.

Hierarchy Dynamics

Use inner auto-morphisms $A^{-1}(X + Y)A = X' + Y'$

[Unpack this to get a Feynman diagram]

$A = \delta X$ for the bubble-up,
$X = \partial A$ on the trickle-down:

$$
\begin{array}{rcl}
ba(a + b)ab & = & -a - b \\
cba(a + bc)abc & = & a + bc \\
dcba(ab + cd)abcd & = & ab + cd \\
dcba(a + bcd)abcd & = & -a - bcd \\
edcba(ab + cde)abcde & = & ab + cde \\
edcba(a + bcde)abcde & = & a + bcde
\end{array}
$$

Try input $(a + b) + (c + d)$ on the 1-2-4 hierarchy:

$$abcd = \delta(ab + cd) = \delta(\delta(a + b) + \delta(c + d))$$

$(a + b), (c + d)$ bubbles reach states $ab, cd \Rightarrow$ write

$$(a + b)ab + (c + d)cd = (-a + b) + (-c + d)$$

whence

$$\delta(-a + b) + \delta(-c + d) = \delta(-ab - cd) = abcd$$

Reflect from top $\Rightarrow$ bubbles become droplets:

$$dcba(-ab - cd))abcd = ba + dc$$

The two droplets hit their xy's:
$$ba(-a + b) + dc(-c + d)$$

& then trickle further down, having now become
$$-a - b - c - d$$

which, being on the sensory boundary, are effector commands, ie.

$$a \to -a \qquad b \to -b \qquad c \to -c \qquad d \to -d$$

The change is complemented, the oscillation completed, and equilibrium maintained.

This is a pure space-like computation.

It reacts to its environment with utter immediacy - what *can* happen is what *does* happen ... and *only* that - in an uninterrupted, purely entropic and subjectively timeless Now.

The computation's deepest "purpose" is to maintain equilibrium with its surround, all the while growing (if possible) new structure based on its sensory experience.

How Awareness Works

Bubble Up/
Trickle Down paths

Backchain links

Impulse
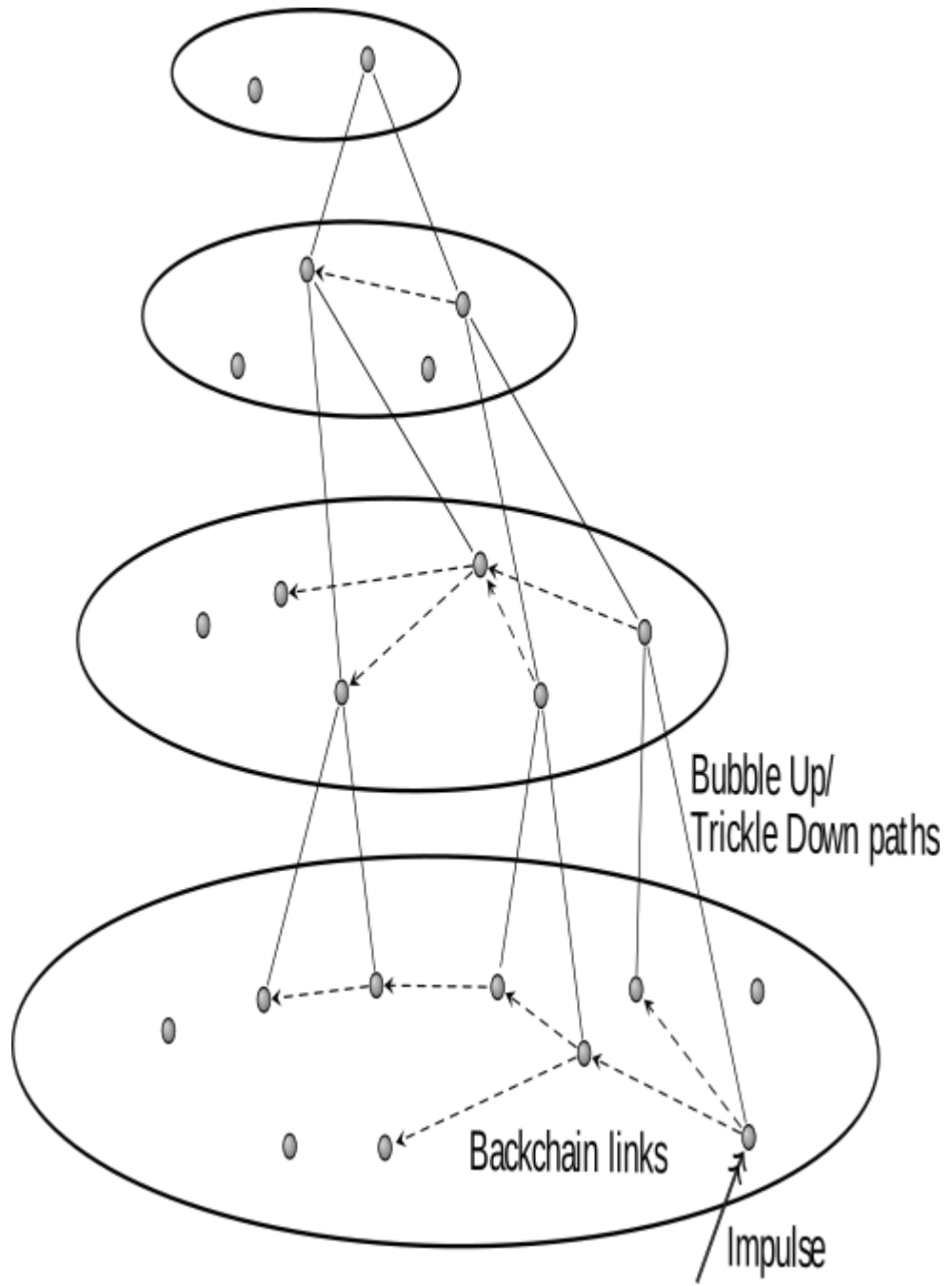
Back-chaining

Suppose env:$\tilde{z} \to z$. *Gotta undo* $\Rightarrow$ *bubble to* yz.

Suppose z *is* <u>grounded</u>, *ie. has an* <u>able</u> *effector.*

So, $z \to \tilde{z}$ *can happen cuz* $z \to \tilde{z}$ *is grounded.*

So $yz \to \widetilde{yz}$ *can happen if also* $y \to \tilde{y}$ *can happen.*
But $y \to \tilde{y}$ *is ungrounded. So* yz *is ungrounded.*

Maybe xy *can do* $y \to \tilde{y}$ *if* $x \to \tilde{x}$ *can happen.*
But $x \to \tilde{x}$ *is ungrounded. So* xy *is ungrounded.*

Maybe wx *can do* $x \to \tilde{x}$ *if* $w \to \tilde{w}$ *can happen.*
Now suppose $wx \to \widetilde{wx}$ *is grounded.*

So the product $(wx)(xy)(yz) = w(xx)(yy)z = wz$
is what happens.

The backchain can be a tree, even a loop
(controlled by the level above).

Note that the back-chaining sequence contains
co-occurrences $ab + bc$ *at each stage.*

The form $ab + bc$ *is that of a unitary electron ...*
$(ab + bc)^2 = +1.$

And level 2 is magnetism, so back-chaining here

captures field lines & current flow.

Let's look at the code!

See RootsOfUnity.org

"Out of the Box: Self-organizing Awareness"

Thread Sensor p.27

Thread Effect p.29

Object Bubble Impulses Up pp.32-33

Thread 1: accept bubble from below

Thread 2: erect back-chain   .

Thread 4: reflect downward at top .

Thread 3: accept trickle-down goal .

Thread Corm: build new 4-tier pp.33-34.

So in the end ...

Same 2^{2^n} xor structure as the Combinatorial Hierarchy; 'distinction' = mutex.

The universe's structure is Descartes' dualism: space-like & time-like.

From our time-like pov, we resolve created-on-the-fly events into a dynamic 3+1d structure.

The physicists' error is to assume that this 3+1d is primary. It isn't.

Rather, the driver is the hyper-exponentially dimensional wave-function hierarchy.

Further, all change occurs via products with entangling quaternionic operators.

So all <u>change</u> is fundamentally space-like.

All <u>things</u> are space-like too: spin, charge, gravity (even matter) & love

Via hierarchical buildup, we are space-like too.

We are made of space

and

resonantly entangled

with

everything.