Predictions

from the paper

TauQuernions τ_x, τ_y, τ_z: 3+1 Dissipative Space out of Quantum Mechanics

by

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CERN confirmed the predicted existence of the Higgs particle on July 4, 2012. The LHC facility will now turn its attention to dark matter, for which the above paper makes a number of detailed structural predictions, summarized in the following.

Notation: the anti-commuting 1-vectors $\{a,b,c,d\}$ are the generators of the geometric (Clifford) algebra $\mathscr{G}_{4,0} = \mathscr{G}_4$ over $\mathbb{Z}_3 = \{0,1,-1\}$; the restriction to $\mathbb{Z}_3$ disables *counting* but pays back with *structure*. $\{w,x,y,z\}$ are wild-cards for a,b,c,d. The tauquernions τ_x, τ_y, τ_z are time-like quaternions, ie. they are isomorphic to quaternions except that they are not reversible. NB: Our interpretation of the $\mathscr{G}_4$ algebra is *purely computational*, and therefore *very* different from those used in physics; see the papers at <tauquernions.com> for the full story.

The Higgs boson: The paper shows that $\mathscr{H} = \tau_x + \tau_y + \tau_z$, which *form* has $2^6 = 64$ sign variants. Of these, 16 are nilpotent, the Higgs boson's various phases:

$$\mathscr{H} = \{X = \pm ab \pm cd \ \pm \ ac \pm bd \ \pm \ ad \pm bc \mid X^2 = 0\}.$$

Normal Matter: The other 48 square to $\pm abcd$, the unit mass carrier, and form the set

$$\mathscr{M} = \{X = \pm ab \pm ac \pm bc \pm ad \pm bd \pm cd \mid X^2 = \pm abcd\}.$$

In addition, both $\mathscr{H}$ and $\mathscr{M}$ are homological boundaries ∂ of $abcd$. We interpret the sign of $abcd$ as its rotational orientation in 3+1 space. Table 5 in <Tauquernions.pdf link>, given in part below, indicates that there are two $\mathscr{M}$-variants of markedly different mass (ie. information content).

Dark Matter: Just as $\mathscr{H} \cup \mathscr{M}$, along with 1 and $abcd$, form the largest *even* sub-algebra of $\mathscr{G}_4$, so $\mathscr{D}$ is the largest *odd* sub-algebra. We define in parallel with $\mathscr{H} \cup \mathscr{M}$ the set $\mathscr{D}$,

$$\mathscr{D} = \{(w+xyz) \ + \ (x+wyz) \ + \ (y+wxz) \ + \ (z+wxy)\}$$

which has $2^8 = 256$ sign variants. $\mathscr{D}$ is our hypothesis for dark matter.

The elements of $\mathscr{D}$ form three subsets, the elements of the first of which all square to quaternionic triplets:

$$\mathscr{D}_q = \{D \in \mathscr{D} \,|\, D^2 = xy + xz + yz,\;\; x,y,z \in \{a,b,c,d\}\;\}$$

and contains 128 elements. We note that $xyz\,\mathscr{D}_q = \pm 1 \pm wxyz + \{H,M\}$.

There are also 96 $\mathscr{D}$'s that are 8^{th} roots of unity:

$$\mathscr{D}_u = \{D \in \mathscr{D} \,|\, D^2 = (w+x)(y+z) \;\&\; D^8 = 1\}$$

Note that $(w+x)(y+z) = -(y+z)(w+x)$, ie. they anti-commute, and so the $\mathscr{D}_u$ possess a spinorial quality. One can also multiply D^2 out: $(w+x)(y+z) = (wy+xz) + (wz+xy)$ and see that these are two tauquernion forms (and, simultaneously, separable states).

As shown in the table, the $\mathscr{D}_u$ contain a further subdivision of $96 = 16+80$, indicating the existence of two types of material dark matter. [This time, $xyz\,\mathscr{D}_u = \pm 1 \pm wxyz + \mathscr{M}$.]

Finally, there are 32 nilpotents, for which $xyz\,D_0 = -1 + wxyz + \mathscr{H}$:

$$\mathscr{D}_0 = \{D \in \mathscr{D} \,|\, D^2 = 0\}$$

Thus $\{xyz\,\mathscr{D}\} = \{-1 + wxyz + \mathscr{H} \cup \mathscr{M}\}$, ie. normal matter and dark matter can be understood as being 3-dimensionally perpendicular to each other. Finally, $128+96+32 = 256$, whence $\mathscr{D} = \mathscr{D}_q \cup \mathscr{D}_u \cup \mathscr{D}_0$.

We also show that

$$D_q^2 = \mathscr{H} + \mathscr{H}'$$

$$\mathscr{D}_u^2 = \boldsymbol{\tau}$$

The $\boldsymbol{\tau}$'s are also entangled states, so (via xyz-rotation) all of the elements of $\mathscr{D}$ are also entangled.

$\mathscr{D}$'s four xyz terms have spin, which could conceivably retain electric charge's like-sign repulsive property, and so could be advanced as a contributor to the vacuum energy. However, re xyz (which squares to -1 and hence is 'polar'), where there's a 'plus' there's a 'minus', which polarity opens the door for (eg.) dark "ionic cluster" formation and the like, a possibility that can at this point only be speculation. Finally, $\mathscr{D}_0$ and $\mathscr{D}_q$, both being roots of zero, will both also presumably contribute to the vacuum energy.

The table below exhibits *exact* bit-contents - because computed combinatorially - for selected items. These values can, at least in principle, be converted to energies using an appropriate function of the Bekenstein relation 4 Planck areas / *ln* 2 = 1 *bit*. The paper explains how all this is reasoned and calculated.

The rightmost four columns of the table exhibit the growing bit content of the given entity as its uniqueness increases in the larger algebras.

The lower the bit content of an entity, the greater its entropy, and therefore its likelihood. So, for example, quaternion 3-space in $\mathscr{G}_4$ has bit-content 15.6, whereas the dissipative Higgs space has bit-content 7.08, and so the latter is the more likely to form (and the former inhabits the latter as a subspace).

Particle/Form		*Vector ($\mathscr{G}_3$ and $\mathscr{G}_4$ samples)*	$\mathscr{G}_1$	$\mathscr{G}_2$	$\mathscr{G}_3$	$\mathscr{G}_4$
$\mathscr{G}_0$						
$\mathscr{V}oid \mapsto \mathbf{0}$	*is*	[· · · · · · · ·]	1.58	4.75	11.1	23.8
$\pm\mathbf{1}$	*are*	[± ± ± ± ± ± ± ±]	1.58	4.75	11.1	23.8
$\mathscr{G}_1$						
a	±*exist*	[− − − − + + + +]	0.58	2.17	7.29	18.9
$\mathscr{G}_2$						
ab	±*spin*	[+ + − − − − + +]	–	2.17	7.29	18.9
$\mathscr{G}_3$						
abc	±*charge*	[− + + − + − − +]	–	–	7.29	18.9
$a+b+c$	γ	[· − − + − + + ·]	–	–	3.29	12.1
$ab+ac+bc$	*3-space*	[· − − − − − − ·]	–	–	5.29	15.6
$\mathscr{G}_4$						
$abcd$	+*mass*	[+ − − + − + + − − + + − + − − +]		–	–	18.9
$q_0^A q_0^B$	*2 qbits*	[· · · · · + − · · − + · · · · ·]		–	–	14.1
$\mathscr{M}_1$	*proto-mass*	[· · · + · + + · + + · + · · ·]		–	–	13.1
$\mathscr{M}_2$	*proto-mass*	[+ + − · − · − + + − · − · − + +]		–	–	7.08
$\mathscr{H}$	*Higgs*	[− · + + · − + − − + − · + + · −]		–	–	7.08
$Bell = ab+cd = \tau'$		[− · · − · + + · · + + · − · · −]		–	–	15.1
$Magic = ab-cd = \tau$		[· − − · + · · + + · · + · − − ·]		–	–	15.1
$a+bcd$	*dark*	[+ · · + · + + · · − − · − · · −]		–	–	15.1
$\mathscr{D}_0$	*dark*	[− · − · · − · + − · + · · + · +]		–	–	5.53
$\mathscr{D}_q$	*dark*	[+ + − · + + − − + + − − · + − −]		–	–	6.87
$\mathscr{D}_u$ (80/96)	*dark*	[− − · · · · − + − + · · · · + +]		–	–	5.53
$\mathscr{D}_u$ (16/96)	*dark*	[+ · · · · · · · · · · · · · · −]		–	–	15.9

Table 1: Information content (in *bits*) of selected $\mathscr{G}_n$ forms.

The underlying algebraic model has no intrinsic need for super-symmetry, ie. that there are undiscovered super-massive bosonic/fermionic partners to known fermions/bosons, respectively. The existence of a spectral basis for geometric algebra is an open question; it is however established that every boson has a fermionic partner. For example, an electron $-1+ab+ac$ is an a-rotation of a photon: $a(-a+b+c)$, and similarly for the proton $-1-a+b+c+ab+ac = a(-a+b+c)-a+b+c) = (1+a)(-a+b+c)$. The lack of need for supersymmetry differentiates this model from string-theoretical models.

And, of course, because we construct $3+1$d $(+---)$ space out of quantum mechanical materials, we are in fact presenting a background-free quantum gravity theory.

We note that the entropy values in the table constitute a kind of *de facto* "table of the elements" - the underlying combinatorics determine every detail. This means, for example, that α, the fine structure constant, is fixed.

Finally, we predict in <Tauquernions.pdf> that

the mechanism underlying gravity is entanglement

whose *e*bits in turn define $3+1$d spacetime in the form of tauquernions.