Gravitation in Symmetrical Context of Space-Time

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0.1 Abstract

Three fundamental properties ("properties") derived directly from fundamental symmetry violations, in combination, give rise to absolute energy states of {space, time, mass, charge}, and four other energy states. A differential view of symmetry violations leads to energy transformations between energy states, summarised as products. Their necessary balance defines closed groups, of arbitrary order. Simple closed groups yield useful results, the simplest being 14 possible closed 4 member groups ("4 groups") of parameters. A single * operation combines binary-valued violations at all scales, to become a practically physical expression, and the concept of number incidentally arises. We suggest that gravitation is one of the eight possible energy states, having a fundamental symmetry relationship with the other seven parameters. Using principles implied by the properties, we propose a means by which matter can be created, propagate, and collapse, using a concise 6-member group. This allow the 'creation' of space during a process of nilpotent instantiation of matter, as expressed alongside the transformation of energy states in other parameters in the closed group. We suggest that this approach can successfully bridge the quantum and macroscopic interpretations, while remaining faithful to the principles of relativity.

0.2 Foreword

This paper is an abridged version of the presentation and draft paper submitted in 2006. It has been edited to remove some aspects that the author has since found to be of no value, or of poor quality. In fairness to the accuracy of the 2006 Proceedings, we have added no new material to this edition, and have provided it as a matter of record. Readers are advised to refer to the 2008 work for a more complete presentation of these ideas.

When reconciling this work to future work, please note that the "Symmetry Space" mentioned here is renamed to "Absolute Phase Space" in future work.

– John Valentine, March, 2009.

1. Introduction

1.1 The Symmetry Space

All the interactions presented here are derived from three fundamental properties ("*properties*").[i] These properties are: (a) *real* or *imaginary*, (b) *conserved* or *non-conserved*, and (c) *dimensional* or *non-dimensional* [1]. States (+*a*, –*a*), (+*b*, –*b*), and (+*c*, –*c*), represent the fundamental aspects ("**parameters**") of our **space**, **time**, **mass**, and **charge**, in specific combinations (see Table 1).

These properties are absolute energy states at the quantum level, and the **parameters** {**space**, **time**, **mass**, **charge**} are specific expressions of energy; a total of eight such **parameters** (the "8-group") are possible from three binary *properties*: {**space**, **time**, **mass**, **charge**}, plus four more, {**A**, **B**, **C**, **D**}.[2]

Using (+*a*, +*b*, +*c*) as **identity**, a 'product number' encodes the difference from **identity**: **identity** has product number 0, and **inverse** has product number 7.

Property	Value +	Value –
a	*+a : real*	*–a : imaginary*
b	*+b : conserved*	*–b : non-conserved*
c	*+c : dimensional*	*–c : non-dimensional*

Table 1: Three Fundamental Properties

Parameter	+ *real* – *imaginary*	+ *non-conserved* – *conserved*	+ *dimensional* – *continuous*
space	$+a$	$+b$	$+c$
A	$+a$	$+b$	$-c$
B	$+a$	$-b$	$+c$
mass	$+a$	$-b$	$-c$
C	$-a$	$+b$	$+c$
time	$-a$	$+b$	$-c$
charge	$-a$	$-b$	$+c$
D	$-a$	$-b$	$-c$

Table 2. Eight possible energy states (parameters).

The **parameters** do not themselves interact: all changes are modelled on the * operation on *property* values, in the manner of a logical exclusive-or, or multiplication; the effect of interacting parameters is achieved implicitly through the interactions on the properties. Members in (a, b, c) are rotation-asymmetric, i.e. can never operate on each other; they only operate on themselves, with reversal resulting from a re-application of change. This excludes direct CPT symmetry rotation, but later we may emulate this rotation by reflections.

$+a * -a = -a * +a = -a$	$+a * +a = -a * -a = +a$
$+b * -b = -b * +b = -b$	$+b * +b = -b * -b = +b$
$+c * -c = -c * +c = -c$	$+c * +c = -c * -c = +c$

*Table 3: Results of the * operation on properties*

Parameters may be implicitly combined by operations on their *properties*, e.g. **mass** * **charge** * **time** = **space**. When interactions between parameters in the 8-group are examined, it can be shown that each 4-group has a symmetrical 4-group: the other four members of the 8-group, e.g. the 4-groups {**space**, **mass**, **time**, **charge**} and {**A**, **B**, **C**, **D**} carry the opposite *properties*, but are only mutually exclusive images of each other if the identity is also inversed in the symmetrical 4-group. Thus, the 8-group can be described as a $D_2 \times C_2$ abelian group, order 8.

Parameter	space	mass	time	charge	A	B	C	D
space	space	mass	time	charge	A	B	C	D
mass	mass	space	charge	time	B	A	D	C
time	time	charge	space	mass	C	D	A	B
charge	charge	time	mass	space	D	C	B	A
A	A	B	C	D	space	mass	time	charge
B	B	A	D	C	mass	space	charge	time
C	C	D	A	B	time	charge	space	mass
D	D	C	B	A	charge	time	mass	space

*Table 4:Results of the * operation on parameters in the 8-group*

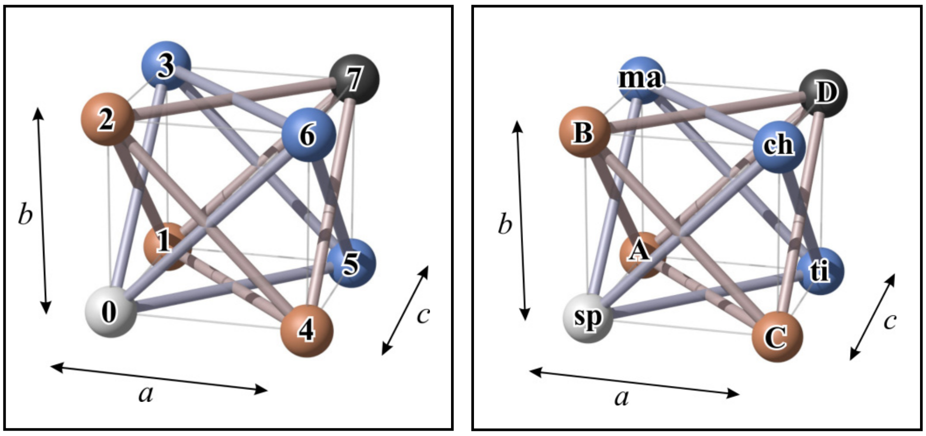

Fig. 1: (left) Product numbers, and (right) energy states in Symmetry Space

"Symmetry space" provides a geometrical representation of the energy states (absolute), symmetry violations (relative), and the relationships between parameters. Fig.1 shows product number 0 (identity) at the bottom, and its inverse at the top. Thick connecting lines represent two symmetry violations; thin connecting lines represent one symmetry violation.

Violations in property *a* operate on a line parallel to the line (0, 4). Likewise, the line (0, 2) corresponds to the axis of property *b*, and (0, 1) to the axis of property *c*.

Closed 4-groups are represented as 2 tetrahedra ({0, 3, 5, 6}, {7, 4, 2, 1}), and the 12 planes connecting any four parameters:

- six faces
  ({0, 1, 5, 4}, {0, 2, 3, 1}, {0, 4, 6, 2}, {7, 6, 2, 3}, {7, 5, 4, 6}, {7, 3, 1, 5})
- six bisecting planes, each connecting opposite edges
  ({0, 5, 7, 2}, {1, 4, 6, 3}, {0, 6, 7, 1}, {2, 4, 3, 5}, {0, 3, 7, 4}, {1, 2, 6, 5})

This makes a total of 14 closed 4-groups, as listed in Table 5. A 4-group's symmetrical inverse can be found by subtracting the group number from 15, reflecting the group in *a*, *b*, and *c*, or by subtracting the product number of each member parameter from 7.

	Parameter Group				Model	non-changing properties
1	**space**	**mass**	**time**	**charge**		—
2	**space**	**mass**	**A**	**B**		*real*
3	**space**	**mass**	**C**	**D**		—
4	**space**	**mass**	**A**	**C**		*non-conserved*
5	**space**	**time**	**B**	**D**		—
6	**space**	**charge**	**A**	**D**	RD 1	—
7	**space**	**charge**	**B**	**C**	Heisenberg#	*discrete (dimensional)*
8	**mass**	**time**	**A**	**D**	Schrödinger	*continuous (non-dimensional)*
9	**mass**	**time**	**B**	**C**		—
10	**mass**	**charge**	**A**	**C**		—
11	**mass**	**charge**	**B**	**D**		*conserved*
12	**time**	**charge**	**A**	**B**		—
13	**time**	**charge**	**C**	**D**		*imaginary*
14	**A**	**B**	**C**	**D**		—

Table 5: All closed 4-groups

#Schrödinger's interpretation can be codified in terms of {**space′**, **time**, **mass**, **charge′**}, with ′ representing the inverse properties, giving {**D**, **time**, **mass**, **A**}. Likewise, Heisenberg uses {**space**, **time′**, **mass′**, **charge**}, giving {**space**, **C**, **B**, **charge**}[3]

2. Useful Symmetries

When parameter pairs are examined, a useful result emerges: for any given pair, there are four pair solutions that can restore the net symmetry violations of that pair.

For example, interacting **space** with **charge** (changing properties *a* and *b*), means that properties *a* and *b* must again be changed to close the system, by any pair of parameters that results in product number 6. This could be {**space**, **charge**} again (nilpotent), or any of {**mass**, **time**}, {**A**, **D**}, {**B**, **C**} (nilpotent effect).

As there are 7 useful product numbers (0 is not included), there are 7 possible net violations for any given energy state. Product numbers for all parameter pairs are summarised in Table 6.

The Elements column describes the trivial matrix operation that would evaluate the symmetry violation. As these are relative symmetry violations, they can be generally expressed as equations using differential calculus, e.g.

$$d([x, y, z]\ [i]) = d([r]\ [i, j, k]) = E \qquad \text{Eq.1}$$

or

$$d([i]\ [r]\ [i, j, k]) = d([x, y, z]) = 0 \qquad \text{Eq.2}$$

As fundamental properties, shown as rows of each matrix, then as factors and polynomial factors:

$$\begin{bmatrix} a_W \\ b_W \\ c_W \end{bmatrix} * \begin{bmatrix} a_X \\ b_X \\ c_X \end{bmatrix} * \begin{bmatrix} a_Y \\ b_Y \\ c_Y \end{bmatrix} = \begin{bmatrix} a_Z \\ b_Z \\ c_Z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \qquad \text{Eq.4}$$

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} \lambda_1 \lambda_2 \lambda_3 = \lambda = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \qquad \text{Eq.5}$$

$$(\lambda_1 - \lambda) * (\lambda_2 - \lambda) * (\lambda_3 - \lambda) = 0 \qquad \text{Eq.6}$$

The parameters or energy state values may be found by factorisation, e.g. polynomial, eigenvector.

3. *n*-Groups: a Tool for Creation and Annihilation

The balancing of symmetry violations is not limited to four parameters. Indeed, we may model instantiation by duplicating some members, to create a larger group, or a near-infinite order by instantiating many 'objects'. We may express Eqs.5,6 in a more general form for a closed system, noting that '0' is relative to the *identity*, and need not be defined in this general model:

$$\begin{bmatrix} a \\ b \\ c \end{bmatrix} \lambda_1 \ldots \lambda_n = \lambda = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} \qquad \text{Eq.7}$$

$$(\lambda_1 - \lambda) * \ldots * (\lambda_n - \lambda) = 0 \qquad \text{Eq.8}$$

The general form for an 'open' system, were E is non-zero:

$$(\lambda_1 - \lambda) * \ldots * (\lambda_n - \lambda) = E \qquad \text{Eq.9}$$

Eqs.7,8 can contain nilpotent terms, e.g. when parameter pairs are duplicated in the creation of a particle pairs. Eq.9 may also contain nilpotent parameter pairs, but the system would require closing to be considered strictly nilpotent.

A closed 3-group is not a useful group, because, given that the identity is one of the parameters, then the second and third parameters must be identical to restore the symmetry. Identical parameters = *identity*, so there would be no energy transfer.

The minimum useful closed group is the 4-group, because it allows identity (domain), and two symmetrical symmetry violations. One of the parameters sets up the violation, and the other two are required to cancel it without themselves being net-ineffective. In the context of differential calculus, the identity serves as the domain. Given that there are two symmetrical violations, then to satisfy the symmetry, another parameter must serve as the co-domain, with the two remaining parameters changing values to allow the pair to describe a symmetrical change.

For point-local interactions, the group contains redundancy or duplication above four members, since violations may be simplified. Duplication enables solutions for interactions or superimpositions, e.g. nilpotent creation and annihilation operations, or illustration of the Pauli Exclusion Principle.

3.1 Rowlands' Nilpotent Dirac State Vector

We believe that the nilpotent formulation of the Dirac Equation can be directly mapped to the above formulation, though the exact mapping is left for future work.

4. Nilpotent Creators of Space

A nilpotent energy transformation that creates 'matter' must create a *conserved* entity state, and a domain state that is *non-conserved* and *dimensional*. The possible target states for the entities are {**charge**, **mass**, **B**, **D**}, and the targets for a non-locality domain state are {**space**, **C**}. The simplest closed group that creates these three new states must contain six members: Two to represent the target states (nilpotent pair, and domain for non-locality), two to represent initial states, and two transforms. The resultant nilpotent pair may be quantum coupled. Any less than six terms, and the identity element nullifies some part of the transformation, and nilpotent creation cannot occur; the transformations in Fig.2 allow identity to be {**T**}, {**V**}, {**T**, **V**}, {**Y**}, {**Z**}, {**V**, **Z**}, or {**T**, **Y**}, but not {**W**} or {**X**}.

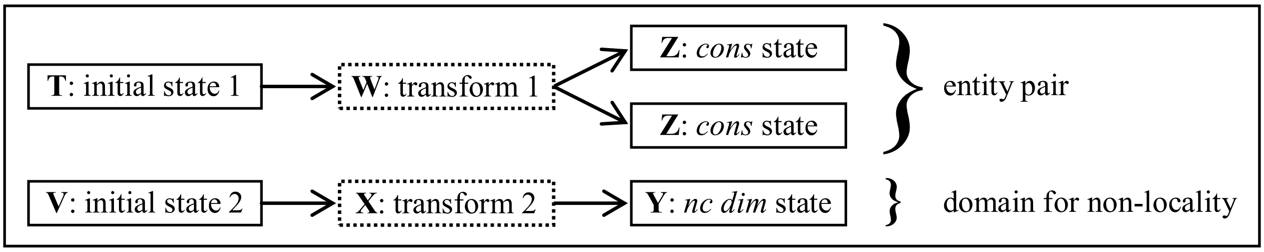

Fig.2: Concise transformation for nilpotent instantiation of entities

For these interactions to be continuously viable thereafter they must be cyclic, otherwise the entity's energy would 'disappear' from observation. Arising from this premise are concepts of zitterbewegung and the wavefunction (it should be easy to create an expansion of the wavefunctions possible using this model). It is here proposed that **Z** represents a matter pair while remaining a single energy state, enabling quantum coupling and requiring special conditions for annihilation (transformation to vacuum energy).

Analyses of binary valued combinations of {**T, V, W, X, Y, Z**} [presented in the original draft of this paper] are of limited value, and have been omitted from this paper.

4.1 Phase Graphs

All property interactions can be expressed as an energy transformation graph. The *x*-axis is a domain of assumed change, otherwise arbitrary. Three continuous graphs are presented: one for each property, with quantisation reticles on the *x*-axis, blobs representing absolute energy states, and traces representing required transformations. Where no trace exists, the transformation is irrelevant. The left side of fig.3 is a minimal representation of fig.2.

For instantiated objects to preserved (and to move in space), they must continue to interact: a wavefunction as a bound pair, or as members of a spatially-separated yet quantum coupled pair with each element interacting independently with other objects. An example wavefunction with two traces is shown in fig.3. A simpler matter wavefunction may have **T**=**Y** and **Z**=**V**, enabling the wave to propagate in a cyclic matter; either two threads follow the same process a half-cycle out of phase from each other, the single thread propagates itself. For such wavefunctions, there will always be matter at any given time, which requires a *conserved* state and a *non-conserved dimensional* state (a non-local domain, like **space**).

The phase graph does not attempt to resolve the values of the dimensional elements of parameter states.

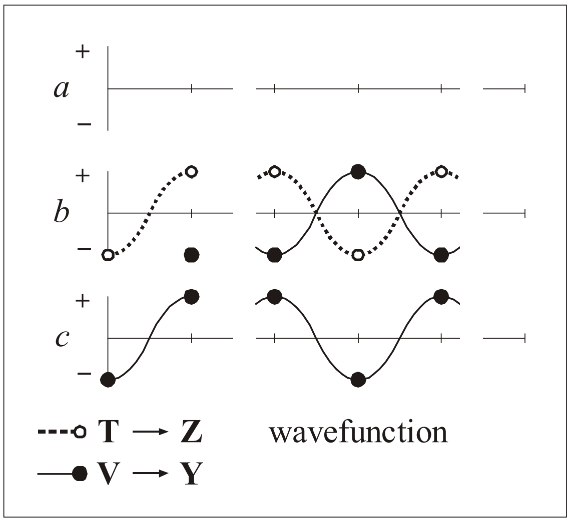

Fig.3: QET graph: (a) nilpotent creation, (b) a compatible wavefunction.

5. Identification of Gravitation

We suggest that parameter **A** is identified as being '**gravitation**'[2]. It is *real* (not *imaginary*), *non-conserved*, and *continuous* (not *dimensional*). The context of interactions between parameters may be summarised by the symmetry breaks 'towards' or 'away from' **gravitation** (7). This helps to understand the 'nature' of parameter **A**.

Parameter	*da*	*db*	*dc*	**Product Number**	**Relationship to Gravitation (A)**
A	—	—	—	0	*identity* of **A**
space	—	—	•	1	*dimensional* **A**
mass	—	•	—	2	*conserved* **A**
B	—	•	•	3	*conserved dimensional* **A**
time	•	—	—	4	*imaginary* **A**
C	•	—	•	5	*imaginary dimensional* **A**
D	•	•	—	6	*imaginary conserved* **A**
charge	•	•	•	7	*imaginary conserved dimensional* **A**

Table 6: Eight energy states (parameters) with Gravitation as identity

This suggests that gravitation is: (1) a *non-dimensional* version of **space**; space rotated into a single dimension is a function of gravitational force, (2) a *non-conserved* version of **mass**, (3) a *real* version of **time**. Thus, the relation between **gravitation** and **mass** is a symmetry break of *conservation*, and so on. This model can reinforce Einstein's general relativity: the net symmetry breaks still occur, and involve the same concepts; it's just that their factored transformation detail is different. We may, for example, choose to include gravitation in terms, rather than just space-time, and model their transformations.

5.1 Perception of Space

When **space** has been created, the model takes on a new complexity: from the quantum to the macroscopic. This demands an exploration into the nature of **space**, and how it applies to energy states and instances of energy states. The creation operation has instantiated (transformed energy) into a *conserved* state, in a *non-conserved quantised* domain.

At the point of creation, the instantiated entities are a solution to the probability distribution function (PDF, which might, or might not, have an infinitesimally narrow range of solutions) on the emerging energy state **space**, with the energy state symmetrical in the 'creation violation' (e.g. **gravitation**). In the same interaction, another transformation makes the transition from *non-conserved* to *conserved*.

With space being translation-symmetric, further incremental transformations to **space** may occur, making separations greater than fundamental unit length.

Our conscious perception of space is worth exploring here, as it creates unhelpful preconceptions. On the human scale, in conditions where chemistry works well, it is easy to think that all matter is suspended within a strictly rigid space. Consider instead the possibility that the human brain constructs a rigid internal model for a statistical distribution of matter – for example, the statement "it is there" is loaded with generalisations. Given a newly-separated pair of particles, the **space** between them, being translation-symmetric, thereafter is subject to distortion from other particles that are now interacting within the field according to their proximity; once created, the space separating the pair becomes less relevant (towards entropy, or background). At fundamental unit length, the origin of transformations is specific. Conversely, the positions of matter particles within a densely-populated **space** can only be determined statistically, because in **space** the effects of an individual interaction cannot be resolved to its source without prior measurements of all other sources in the system. As humans, it is only by solving the relative distances statistically that we can gain an understanding of matter within local space.

5.2 A Note on Time and other Parameter Names

It is the author's belief that the parameter **time** is a misnomer, and that perceived time is simply a consequence of *any* symmetry-breaking 'clock' *at macro-scale*. The parameter **time**, as listed in Table 2, is a *imaginary* and *continuous* energy state that defines a 'direction', disallows physical reversal, and yet allows either sign of (squared) mathematical solutions if it were to be made *discontinuous*, similar to our physical understanding of classical time.

One of the problems of this scheme is that parameter names are loaded with our interpretation of classically-observed effects, particularly concerning mass (inertia, or rest mass), momentum and motion; perhaps we should be aiming for a more fundamental view for naming the parameters, even to the extent of finding new terms to describe their true nature at their smallest scale.

6. Approaches to Grand Unification

6.1 Alternative Views of Physics

Expressions that successfully unify all energy states are likely to comprise sums of three terms, corresponding to the three violations of fundamental properties, e.g.

$$|\partial E| = |\partial a| + |\partial b| + |\partial c| \,,$$

$$(\partial a + \partial b + \partial c)(\partial a + \partial b + \partial c) = 0,$$

or

$$E = (\partial a + \partial b + \partial c)(\partial a + \partial b + \partial c)(\partial a + \partial b + \partial c).$$

The more useful analyses will result from a reduction to the fundamental symmetry violations, from which a choice of 'expressions' emerge from the selection of a context for transformation, i.e. the selection of identity and variable parameters in a process of compactification, like that in Rowlands' re-write of the Dirac state vectors. It is the author's belief that with different perspectives, we may use the same technique to reach new insights; this 'Pieces of Eight' model could offer new ways of looking at physics. First, there is the completeness offered by combinatorial analysis of groups and dimensional values. Second, there is the transformation from one group to another, to shed new light on old views of interactions. For example, it should be possible to model the same group in different ways: the symmetry violations will be the same in each, but the dimensional elements will have different values as a result of measuring or transformation, and the solutions will be presented in different parameters.

7. Appendix

7.1 Levels 0 to 3

It is convenient to split this model into four levels. Note that some concepts propagate through the levels.

Level 0	From unity to fundamental symmetry violations (fundamental properties). This is a small hierarchy originates the CPT symmetries, and privileges them to be distinct and independent of each other.
0.0	Unity : U = ***?***
0.1	Parity : U = $-u * -u$
0.2	$u = -u * -u$
Level 1	Fundamental *properties.*
1.1	$\pm u * \pm d(u) \Rightarrow$ *symmetry violation.*
Level 2	Quantum value, energy states as **parameters**
2.0	A set of eight parameters is identified as the complete set of unique combinations available from the fundamental properties.
2.1	Parameters carry only fundamentally quantum binary (or balanced ternary value in combination), according to the properties.
2.2	Delta states for differential calculus. Identifies correlating symmetry in transfer of value between parameters when property symmetry is violated.
Level 3	n-groups and the macroscopic.
3.0	Instantiation, duplication, concept of number, nilpotent creation.
3.1	Macro effects, incomplete (mid-phase sampling of) violations, distant relativistic interactions.

Table 7: Summary of useful Levels for effects of symmetry violations

7.2 Pairs of Zero-Result States

Pair Number	Parameter Pair		Product Number	Dimensional Elements (first pair)	
0, 9, 18, 27, 36, 45, 54, 63	any matching pair		0		
1†,8	**space**	**A**	1	3,1	[x, y, z] [r]
26, 19	**mass**	**B**		1,3	[m] [x, y, z]
44, 37†	**time**	**C**		1,3	[i] [i, j, k]
55, 62	**charge**	**D**		3,1	[e, s, w] [q]
2†, 16	**space**	**B**	2	3,3	[x, y, z] [x, y, z]
25, 11	**mass**	**A**		1,1	[i] [r]
47, 61	**time**	**D**		1,1	[m] [q]
52, 38†	**charge**	**C**		3,3	[e, s, w] [i, j, k]
3†, 24	**space**	**mass**	3	3,1	[x, y, z] [m]
46, 53	**time**	**charge**		1,3	[i] [e, s, w]
10, 17	**A**	**B**		1,3	[r] [x, y, z]
39†, 60	**C**	**D**		3,1	[i, j, k] [q]
4†, 32†	**space**	**C**	4	3,3	[x, y, z] [i, j, k]
31, 59	**mass**	**D**		1,1	[m] [q]
41, 13	**time**	**A**		1,1	[i] [r]
50, 22	**charge**	**B**		3,3	[e, s, w] [x, y, z]
5†, 40	**space**	**time**	5	3,1	[x, y, z] [i]
30, 51	**mass**	**charge**		1,3	[m] [e, s, w]
12, 33†	**A**	**C**		1,3	[r] [i, j, k]
23, 58	**B**	**D**		3,1	[x, y, z] [q]
6†, 48	**space**	**charge**	6	3,3	[x, y, z] [e, s, w]
29, 43	**mass**	**time**		1,1	[m] [i]
15, 57	**A**	**D**		1,1	[r] [q]
20, 34†	**B**	**C**		3,3	[x, y, z] [i, j, k]
7†, 56	**space**	**D**	7	3,1	[x, y, z] [q]
28, 35†	**mass**	**C**		1,3	[m] [i, j, k]
42, 21	**time**	**B**		1,3	[i] [x, y, z]
49, 14	**charge**	**A**		3,1	[e, s, w] [r]

Table 8: Parameter pairs and their product numbers

7.3 The nature of properties

The fundamental properties (*a*, *b*, *c*) are each responsible for a specific type of energy transformation. In context, secondary effects result.

property	transformation	context-based effects
a	parity?	complexification. reflection.
b	conservation	instantiation / annihilation; conservation / non-conservation; point / field; translation.
c	dimensionality	dimensional / (one- or non-dimensional); discrete / continuous; divisible / indivisible; (implicit rotation, translation).

Table 9: the nature of properties and symmetry violations

7.4 Further Explorations

7.4.1 The parameters {**A**, **B**, **C**, **D**} are thought to be 'vacuum states', and can account for 'extra energy' that is not immediately resolvable. Vacuum states are merely parameters that are not members of the group under consideration. Preliminary work[2] suggests parameter **B** is akin to linear momentum, and **C** to spin in some contexts. Native effects are difficult to ascertain, because of the lack of perspective; our experience of physics is the effect of a compactified network of states and changes.

7.4.2 This model could find options for energy transformations in 'black holes', neutron stars, and other extreme conditions.

7.4.3 How can multiple instances of energy states occur simultaneously? Are simultaneous particles actually the same energy state at different times [Wheeler-Feynman]? What is causality and the 'arrow of time'?

8. References

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Supplementary materials are being developed at `http://johnvalentine.co.uk/po8`