How SI Units hide the equal strength of gravitation and charge fields

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This paper shows that there are deeper symmetries within physics than are currently recognised. The use of SI units in their existing form hides that gravity is not the weakest force. The paper shows through symmetry arguments that Planck's constant *h* and the Gravitational constant *G* are both dimensionless ratios when dimensional analysis is used at property levels deeper than mass, length and time. The resultant adjustments shown to be needed for SI units produce much simpler sets of units which also solve the issue of why magnetic field H and magnetic inductance B have not previously had the same units. The result shows that gravitational and charge fields have the same strengths when considered in fractional adjusted-Planck values. By showing that *h* and *G* are dimensionless, they can be understood to be unit-dependent ratios which can be eliminated from all equations by merging them within new adjusted SI units. The implications are that mass and charge sizes, and distance, are not the properties which separate quantum and classical gravitational systems. The equivalence of gravitational and inertial mass is also shown. The new type of dimensional analysis shows how to uncover any law of nature or universal constant and that the current set of properties of nature is missing two from the set, whose dimensions and units can be inferred.

Keywords: Symmetry; Gravitational constant; Planck constant; Planck units; SI units; Dimensionality; Properties; Parameters; Ratios; Field strength.

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I. INTRODUCTION: BACKGROUND

The paper by Mohr et al. [1] explains the current state, where SI units are being bought more into the quantum measurement realm. The paper by M. J. Duff et al. [2] includes a broad and varied introduction to the problems of fundamental units and also covers their relationship with SI units. The issue is not new [3,4], but has missed the deeper implications on the relative strength of gravitational and charge fields.

To paraphrase Dr Okun [5] – "The use of fundamental units *h* and *c* in SI has introduced greater accuracy in some of the units, but some electromagnetic units are based on pre-relativistic classical electrodynamics and so their measurement is not as accurate as other units. The use of permeability and permittivity spoils the perfection of the special relativistic spirit and, whilst this is useful for engineers, it results in the four physical properties D, H and E, B having four different dimensions".

It is only by starting with the most basic, symmetrical and simple physical maximal sized set of Planck type units - and maintaining the integrity of the relationships within that set by not stretching property space unequally - that it is possible to see that the electromagnetic and mechanical properties are misaligned versus each other and that the current value of permeability (and thus permittivity) results in a further misalignment.

A new form of dimensional analysis underpins this and allows both mechanical and electromagnetic properties to be treated on an identical basis. It addresses Dr Okun's concerns in that the pair magnetic inductance *B_*, and magnetic field *H_* are shown to have the same units, separated only by the new dimensionless ratio $\sqrt{|G|}$ which replaces permeability. For electric field ξ_- and electric displacement field D_ the relationship factor is the permittivity ε_-, equal to c^{-2} in DAPU units, as explained below, meaning that D_ is an energy.

There appears to be no current work in this field, trying to investigate physics by simplifying the measurement system and units used. The author has privately experienced the complete reverse view, that no new physics can be uncovered from simplifying units. This paper is a riposte. On the foundations of the changes to SI units, it is possible to show that gravitational and charge fields have the same strengths when considered in fractional adjusted-Planck values.

II. METHODOLOGY

This paper shows, using very simple manipulation of formulae based around Planck units, that both *h* and *G* can be eliminated from all formulae as being dimensionless ratios – numbers set by the choice of units – and that this implies that gravitational and charge fields have the same strength.

This paper is not directed at simply changing units, as in the case of the misalignments existing in current SI units, but shows how clearing up and simplifying those units enables hidden deeper relationships between properties to be uncovered.

III. SIGNIFICANCE AND OBJECTIVES

The significance of the paper lies mainly in the reinterpretation of *h* and *G* which undermines current notions of where the quantum world ends and the classical world starts. Without the misguided emphasis on large/small distances and masses and the differential strength of charge and gravity fields, it is not clear what properties define where the quantum world becomes classical and vice versa.

The paper sets out from the premise based on symmetry that our physical properties are built on deeper dimensions, and that identifying those dimensions will give us better tools to explain what we observe.

The first issue that needs investigation is why SI units do not work consistently together across mechanical and electromagnetic properties. The solution is to adjust the SI value of charge and split Planck's constant *h* and the Gravitational constant *G* between mass and distance parameters, rather than just mass alone, plus a small redefinition of the value of permeability. But to do this requires understanding of the dimensionality of all the properties – meaning how they are related to each other and to a single base property which can be used to define triple-adjusted Planck units (TAPU) and their new SI values.

The splitting of the adjustments between mass, charge and distance properties is novel because usually *G* is considered only to be mass-specific and *h* has never before been subject to elimination in this manner. Also the Planck charge is usually taken to be the electronic charge size, rather than the larger size implied through symmetry by the Planck mass, but here it is the latter that is used as the ultimate maximum size, with the two different sizes leading to two different sets of adjusted-Planck units.

The result shows that only some fundamental constants are really constant, and that those which are, are actually ratios whose size is set by the choice of units.

The objective is to show that the strength of gravitational and charge fields are the same for fractional adjusted-Planck values. This implies on the small scale that within the nucleus the actions of gravity probably are as important as charge and that possibly the strong force is gravity in disguise, working with charge. And on the large scale that the universe may not be as large as currently calculated.

IV. EQUATIONS USED

It might be reasonably asked why the simple rearrangements of Planck mass $M_p = \sqrt{\hbar c / G}$ into triple-adjusted Planck mass $M_T = M_p \sqrt{G/\hbar} = \sqrt{c}$ and Planck length $L_p = \sqrt{\hbar G / c^3}$ into triple-adjusted Planck length $L_T = L_p / \sqrt{\hbar G} = \sqrt{c^{-3}}$ as the base cases used here should need so much explanation. This will become clear below.

Since only the dimensionality, explained later, of each property in these Planck-size based equations is what matters initially, the use of *c* rather than v for velocity is not an issue. Each property in the Planck formulae takes its appropriate and accepted initial Planck value, apart from charge Q which here is the larger size, rather than the actual charge size that is experimentally observed which is $\sqrt{\alpha / 2\pi}$ smaller.

Amongst the issues are the units of *h* and *G*, which are not immediately obviously dimensionless ratios, the deeper dimensionalities of properties which allow the new maximum value of mass and minimum value of length to be described in terms of powers of *c* and the parallel treatments of two sizes of Planck charge based on either an observational basis or on a symmetry argument.

The symmetry argument is that the foundation Planck size for charge is not the electron charge observed, but a TAPU size Q_T related to the TAPU mass M_T only by *c*. The underlying symmetry has been hidden by two misalignments within SI units.

No indications of the accuracy of any property values are given in the paper because the main final values are all powers of $\sqrt{c}$ which is defined in SI units as being exact. The only factor remaining within the paper with any experimental error is the value of the dimensionless fine structure constant α . That it is dimensionless suggests that it really is a constant.

V. FOUNDATIONS

All the equations in the paper use only Planck values, unless specifically mentioned otherwise. The Planck, or adjusted-Planck, values are call 'maximal' in that they represent either the largest (eg velocity, *c*) or smallest (eg distance, L_p) that is possible for that property. The Planck unit sets are eventally based in TAPU form on the maximal values using either Q_T as explained below for the 'larger' set and q_{eT} for the 'smaller' set.

The most basic two formulae for defining a Planck unit sized system are the gravitational and charge force equations $F = G\ M^2/L^2 = Q^2 c^2 / L^2$ and the quantum angular momentum equation $h = M\ c\ L$. The normal usage of the latter is to define a Planck mass M_p and Planck Length L_p such that $\hbar = M_p c\ L_p$ and $M_p = \sqrt{\hbar\ c\ / G}$.

The transformation is to replace the Planck set by the

TAPU set, such that

$$M_T = M_p \sqrt{G/\hbar} = \sqrt{c} \text{ and}$$

$$L_T = L_p / \sqrt{\hbar G} = \sqrt{c^{-3}}$$

The force equation provides the simple relationship that the Planck mass M_P and theoretical larger Planck charge Q_P are related such that $M_P\sqrt{G} = Q_P c$. Since the latter equation does not include L_P it is not immediately apparent that there is a need to adjust Q_P into Q_T by using $\sqrt{h}$ and $\sqrt{2\pi}$ so that $M_T = Q_T c$ if the latter factors are distributed in the same way as $\sqrt{G}$. As mentioned, this stretches property space equally along the mass and length properties, rather than just the mass property as is usually done when trying to eliminate *G* [6].

It is also possible to define a useful intermediate adjustment that retains *h* in order to provide simplified SI values that can be compared with observable measurements, such that the DAPU set consists of:

$$M_* = M_p\sqrt{2\pi G} ,$$

$$Q_* = Q_p\sqrt{2\pi}$$

$$L_* = L_p\sqrt{2\pi / G}$$

with $h = M_* c L_*$, where Q_* is the DAPU charge. This is the maximum charge based on symmetry with the maximum mass and is not the electron charge, which is considered later.

The result is the foundation of a DAPU property set and units based on

$$h = M_* c L_* \tag{1}$$

and

$$F_* L_*^2 = M_*^2 = Q_*^2 c^2 = h c \tag{2}$$

which excludes *G*. The dimensionality of *G* will be shown to be zero later.

This is the most basic set of Planck properties that can be devised using two universal constants *h* and *c*. However, as shown before, only c is required in the maximal TAPU set.

The relationship between M_* and Q_* is simply $M_* = Q_* c$ with the deeper relationships $M_* = \sqrt{hc}$ and $Q_* = \sqrt{h/c}$.

VI. EQUIVALENCE

Considering inertial and gravitational mass, the starting point is the simple DAPU relationship

$$F_* L_*^2 = M_*^2 = Q_*^2 c^2 = M_* c^2 L_* = h c \tag{3}$$

Here now there is no need to differentiate between the *M* of the gravitational side of the equation and the *M* of the inertial side because the treatment of both *M*'s is identical and the result independent of *G*.

The subsuming of *G* within the mass and distance units eliminates the difference between gravitational and inertial masses, since there is no longer any purely gravitational mass.

This is not equivalent to making *G*=1 because the effect of subsuming *G* into M_* and L_* is to stretch current property space into the more symmetric DAPU properties space, which does not occur when simply setting *G=1*.

The result of eliminating *G* is also that the field strength of any fractional charge q_f / Q_* is equal to the same strength of gravitational field for an equal fractional mass m_f / M_*, the actual factor between the two being *c*.

To maintain the topology and symmetry of the base property space requires that the two properties *M* and *L* are stretched proportionately together. Provided *Q* is treated in the same way as *M*, it will stay symmetric. Any non-symmetric stretching results in an asymmetric set of properties and will require the use of factors such as $\sqrt{\alpha/2\pi}$ in the relationships between the stretched properties.

VII. SI UNITS AND DAPU

The above two relationships hold in the system in DAPU units, but unfortunately in SI units the first misalignment becomes apparent. To align the charge and mass side of the Planck equation in SI units requires that the base unit size Planck charge is altered by the factor $\sqrt{1\times10^{-7}}$ relative to the mass side since $G M_P^2 / L_P^2 = Q_P^2 c^2 (1\times10^{-7}) / L_P^2$ in SI units.

To identify this difference, each equation in future may, where it might otherwise confuse, be identified either as being in DAPU or SI units, so that

$$Q_* = M_*/c \;(DAPU) = M_*\sqrt{1\times10^{7}}/c \;(SI) \tag{4}$$

It is useful for display purposes, as will be used liberally later, to define a factor

$$d = \sqrt{\alpha/2\pi} \tag{5}$$

which represents the ratio $d = q_{e*}/Q_*$, where q_{e*} is the DAPU size of the electronic charge.

The second SI misalignment appears when comparing electromagnetic and mechanical SI units that have material content requiring permeability or permittivity.

The use of permeability u_* as $4\pi\times10^{-7}$ causes the factor $4\pi\times10^{-7}/\sqrt{|G|} = 1/6.501$ to appear in some properties when compared with what their DAPU based value should be. This arises from some properties whose SI units may mix electromagnetic and mechanical properties within their definition, such as the Farad. So the second SI re-alignment is to define u_* to be equal to the ratio $\sqrt{|G|}$ rather than the usual $4\pi \times 10^{-7}$, which relegates $|G|$ from gravitational to permeability use, so that it represents a measure of the strength of interactions within materials, not between masses. It will be shown below that u_* and $\sqrt{|G|}$ both have the same units, in that they are both dimensionless. The value of permittivity also needs to be adjusted to maintain the value of its product with permeability.

The result is that the proposed new adjusted-SI units (NSI) which should be used are either the same as the normal SI units or are different to normal SI units by a power of either the ratio $\sqrt{|G|}$, the $\sqrt{1 \times 10^{-7}}$ factor, the 6.501 factor or a combination of these. Wherever there is a factor q_{e*} used, the same power of $\sqrt{1 \times 10^{-7}}$ is used. Where there is no q_{e*} or u_* factor, the NSI and SI values are the same. In this paper, where the current SI unit is adjusted by a power of the $\sqrt{1 \times 10^{-7}}$ factor, the property unit has a cedilla above it $\hat{U}$, or as a subscript in the tables thus $U_\wedge$. So the SI unit Watts, W becomes $\hat{W}$ in NSI where $\hat{W} = \sqrt{1 \times 10^{-7}} W$. Note that NSI units include *h*, but will be changed to Brand New SI units on the elimination of *h* later when considering values in TAPU units.

Because most of the property examples used in this paper do not have any specific material dependence, as would be the case for the magnetic field *H*, there is no use of permeability u_* or permittivity ε_* within most of the property examples given, except to show that Magnetic Field H and magnetic inductance B have the same underlying units. For the examples used here, there are no complications of additional 6.501 usage or identification of double adjusted SI units, other than in the permittivity ε_* and capacitance C_*, where the SI unit the Farad F is adjusted by that factor to be $F^\#$ in NSI with $F^\# = F\ /6.501$.

So the adjustment of SI units to make them self-consistent across both mechanical and electromagnetic properties, and to ensure that they have the same overall shape in property space as the underlying DAPU units, allows the direct comparison of all properties in either DAPU or NSI units, with the only difference being the actual number value in each set of units.

For the Q_* set of properties, in DAPU the maximal values are always one multiplied by the combination of *h* and *c* representing that property, except where $\sqrt{|G|}$ is needed. For the q_{e*} set of properties, the maximal values are always powers of *d* multiplied by the *h*, *c* combination, again except for $\sqrt{|G|}$.

For both these sets, the NSI values are shown in tables 1 and 2, with translation factors between units in table 3. The SI values should be multiplied by the factors in the appropriate column to produce the DAPU values of that property.

VIII. DIMENSIONALITY OF *h* AND *G*

The new dimensionality analysis goes deeper than considering properties in terms of mass, length and time by uncovering a dimension in which adjusted-Planck sizes of mass, length and time are themselves only powers of a single underlying property.

The subsuming of *G* within the DAPU mass M_*, and the DAPU length L_*, would seem to ignore the units of *G*, effectively treating G as being without units. This is not the case since *G* has units of $m^3 kg^{-1} s^{-2}$, but it is necessary to show that, based on Planck sizes, these units cancel completely to leave only a ratio.

A consideration of the standard laws of nature and the fundamental constants through a form of dimensional analysis shows that if each property at its Planck size is assigned an appropriate dimensionality, every fundamental constant, other than *c*, will have a total dimensionality of zero, or to state the reverse – every property that has dimensionality of zero is a fundamental constant.

The dimensional analysis consists of solving for a basis vector in vector Planck property space which produces zeroes of dimension for four important constants of nature, *h*, *G*, Permeability (*u*) and Boltzmann's constant k_B.

Using *h* and *G* in the analysis may appear circular, but the analysis supports their use. It also shows that Boltzmann's constant, like *h* and *G*, is simply a ratio that can be discarded in the correct units and that there may exist other properties, as yet unrecognized, that correspond to missing dimensionalities.

The dimensionalities of the main SI, NSI, DAPU or TAPU properties in terms of a hypothetical dimension Y that emerge from the consideration are:

Mass $M_* = Y^{+1}$	Velocity $c = Y^{+2}$
Length $L_* = Y^{-3}$	Energy $E_* = Y^{+5}$
Charge $Q_* = Y^{-1}$	Time $T_* = Y^{-5}$
$h = Y^0$	$G = Y^0$

The units of G are $m^3 kg^{-1} s^{-2} = Y^{-9} Y^{-1} Y^{+10} = Y^0$ dimensionality and h has units of $m^2 kg\ s^{-1} = Y^{-6} Y^{+1} Y^{+5} = Y^0$ dimensionality. So the units of both *h* and *G* are actually irrelevant because they represent fundamental constants with zero dimensionality. Similarly Boltzmann's constant has units of $J \ K^{-1} = Y^5 Y^{-5} = Y^0$ dimensionality as well.

Thus adjusting the Planck mass to the DAPU mass, and Planck length to DAPU length, involves only multiplying or dividing by the ratio $\sqrt{|G|}$ and $\sqrt{2\pi}$ as dimensionless numbers, and does not affect the dimensionality of the units of mass, charge or length, other than changing the sizes of the base Planck mass, charge and distance units. This stretches the current property space into the more symmetric DAPU property space, which is different to treating *G* to be equal to one, which does not affect the current property space topology at all.

The same analysis can be done for permeability to give units of $u_* = N \ A^{-2} = m^{-1} kg \ s^{-2} (\sqrt{kg \ m \ s^{-1}})^{-2} = Y^0$ dimensionality which shows that the replacement of u_* by $\sqrt{|G|}$ does not affect the units used because they are both dimensionless.

IX. PRODUCING LAWS OF NATURE

This hypothetical dimensionality tool can be used to produce any law of nature by creating equations where the dimensionalities are equal on both sides.

One example from the tables would be $F = M \ a$, where force is Y^{+8} and is equal to the product of mass Y^{+1} and acceleration Y^{+7}, so that both sides have Y^{+8} dimensionality. Another example would be the product of volume and viscosity which produces Y^0 on one side and could represent a new constant of nature on the other. To produce a constant of nature, aside from *c*, the minimum that is required is that it has Y^0 dimensionality. In this instance, there is no need for a new constant since the product of volume and viscosity is equal to *h*, through $V_* \eta_* = h$ in DAPU.

However, producing laws of nature through dimensional analysis of Planck unit sizes does not provide the exact relationship between the fractional Planck property values, because these depend on the specific context in which the properties are being considered. An example would be the kinetic energy of a particle in motion $E_{ke} = (\ \gamma_v - 1\ ) m \ c^2 \cong \ 0.5 \ m \ v^2$ compared with the rest mass energy of the same particle $E_{rm} = m \ c^2$. Dimensionally, at Planck unit sizes, these two formulae exhibit the same relationships between mass, energy and velocity but as fractional Planck values they describe different specific aspects of that relationship.

X. VALUES OF THE Q_* SET OF PROPERTIES

Table 1 provides a list of the main Q_* property set and their NSI values at their maximal Planck sizes. The set is produced by starting with the base property space *M*, *h*, *L*, *c* and *Q* and extending through the use of standard formulae to find each additional property value in this 'larger' set. The column headed 'NSI units' means that where the current electromagnetic SI units appear they have been adjusted by a power of the factor $\sqrt{1 \times 10^7}$ mentioned earlier and their use is denoted by a cedilla above the unit or $F^{\#}$ describes the SI unit F adjusted by the 6.501 factor. Note that the factor *d* does not appear in table 1 because these values are all based on the DAPU charge Q_*

XI. von KLITZING AND JOSEPHSON CONSTANTS

The discovery that the von Klitzing constant $R_k = h / q_e^2$ [7] and the Josephson constant $K_j = 2 q_e / h$ [8] could be measured directly has improved the precision of measurement of *h* and some SI electromagnetic units [9]. It is unfortunate that the misalignment of SI units between mechanical and electromagnetic properties has not been addressed before.

These two experimentally measured 'smaller' Planck unit constituents can only easily be shown to be members of that set if the current misalignment of SI units is corrected initially into New SI units (NSI) and then finally into Brand New SI units (BNSI).

This is shown in both formulaic and numerical comparisons.

What emerges from the q_e set are values in the new fundamental units for R_k and K_j. These two constants are members of the set of q_{e*} units, as should be expected, although K_j appears inversely and twice the anticipated size. From these two observable constants (which are not universal constants because their dimensionalities are not equal to zero) all the other q_{e*} set of adjusted-Planck property values can be constructed as power combinations.

The dimensional analysis used to subsume *G* and *h* is employed to show that R_k can be considered as equivalent to a velocity, and that many of the electromagnetic properties can similarly be considered equivalent to mechanical properties. This invites a reinterpretation of not just R_k and K_j, but of all electromagnetic properties.

The measured value of R_k is shown to equate to a speed greater than light speed. Although it is not clear whether this increased maximum velocity applies to either physical objects, the media through which the physical objects travel or patterns created by subluminal physical objects, this can be experimentally tested. The experimentally observed value of R_k probably implies that a minimum electron velocity is required in order to pass through resistive materials.

XII. R_k AND K_j - MEMBERS OF THE q_{e*} PROPERTY SET WHOSE VALUES CAN BE MEASURED DIRECTLY

The maximal value for Resistance R_{e*} is equal to the von Klitzing constant R_k,

$$R_{e*}= R_k(DAPU) \quad (6)$$

and the value of the Magnetic Flux ϕ_{e*} is equal to twice the inverse of the Josephson constant K_j,

$$\phi_{e*} = (2/K_j)(DAPU) \quad (7)$$

Table 3 shows that the NSI values of R_k and K_j are identical to R_{e*} and $2/\phi_{e*}$ when translated into DAPU units by multiplying by the factor 1×10^{-7} for R_k $(2.58128076 \times 10^4 \Omega\ (SI))$ and $\sqrt{1 \times 10^{-7}}$ for K_j $(4.835870 \times 10^{14} H\ V^{-1}(SI))$.

XIII. VALUES OF THE q_{e*} SET OF PROPERTIES

In DAPU the value of each property in table 1 is one multiplied by the constants factor containing *h* and *c*, except where $\sqrt{|G|}$ is needed. To arrive at the maximal real values that can be found experimentally, the list needs to be adjusted to use q_{e*} instead of Q_* since we do not observe Q_* charges usually. As before, the base property space is extended using standard formulae to produce the maximal values in this new 'smaller' set. The maximal values in NSI units of some properties under this limitation are listed in table 2. Note that the power of the factor *d* is inversely proportional to the dimensionality of every property.

XIV. PROPERTIES, PHYSICAL CONSTANTS AND LAWS OF NATURE

All the properties in tables 1 and 2 have been produced using standard relationships and formulae. It is interesting to observe that some properties on the mechanical side have identical size and dimension partners on the electromagnetic side, for example mass M_* and magnetic flux ϕ_*.

To ensure that the above values can be understood properly, the following series of relationships at the Q_* level can be culled from standard laws and the results confirmed to be correct using their NSI values in table 1 as:

$$F_* = (M_*/L_*)^2 = (\phi_*/L_*)^2 = M_* a_* = \phi_* B_* = i_*^2 \quad (8)$$

It is also possible to use the same relationships at the q_{e*} level, using the property values from table 2 thus:

$$F_{e*} = (M_{e*}/L_{e*})^2 = (\phi_{e*}/L_{e*})^2 = \phi_{e*} B_{e*} = i_{e*}^2 \quad (9)$$

Since the values of some electromagnetic properties are identical to the values of some mechanical properties, it suggests that mechanical formulae could be used with electromagnetic properties substituted instead, and vice versa.

One example would be the simple $L_{e*} = v_{e*} T_{e*} = \angle_{e*}$ which suggests that in some way electromagnetic inductance is equivalent to a mechanical distance. Were this only done in SI units, the mix of mechanical and electromagnetic properties would not show that the properties were interchangeable because of the misalignment of those two types of property in the SI units system.

The tables show that most electromagnetic properties can be reinterpreted in terms of mechanical properties. It requires a complete reinterpretation of what is understood by the terms magnetic inductance (acceleration), magnetic flux (mass), inductance (distance), current density (mass density) and other electromagnetic properties.

XV. EQUIVALENCE OF ELECTROMAGNETIC AND MECHANICAL PROPERTIES IN EXPERIMENTS

The new law of nature mentioned earlier, producing Planck's constant *h* as the product of DAPU volume V_* and viscosity η_*, together with the equivalence in DAPU units of viscosity η_* and electric field ξ_*, provide two interesting possibilities, one already experimentally hinted at.

Firstly, that any fundamental physical framework based on a single fundamental particle of one volume size, which combines with others in a composite structure and moves against a background viscosity, would have similar viscosity acting on the motion of every such component particle. This would be equivalent to the action of air resistance on a skydiver, providing a terminal velocity for all such particles.

The same type of action on such fundamental particles could be the underlying reason for the terminal velocity that we describe as light speed, the irreversible arrow of time as energy is always lost in motion to overcome viscosity and could also provide an additional redshift factor to the passage of photons, almost completely directly related to their distance travelled, reducing the real size and expansion rate of the universe. Correspondingly, where such viscosity is not present, there will be no maximum velocity and non-locality could result. It may be that the presence of viscosity produces a relativistic environment and an absence of viscosity produces a quantum environment.

Secondly, and having potential experimental justification, is that viscosity η_* and electric field ξ_* could be the same property in different disguises. A recent paper [10] mentioned that the 'stickiness' of spiders' silk could be turned on and off through the application of an electric field. If such stickiness and viscosity are related, then this would show directly how viscosity is related to electric field and vice versa. This effect would not the same as the creation of magnetorheological fluids [11] with dual fluids, but would be describing a deeper level of equivalence.

XVI. TRIPLE-ADJUSTED PLANCK UNITS

Having reintroduced *h* earlier in order to show clearly the link between the q_{e*} set of property maximal values and R_k and K_j, it is now useful to eliminate it again to produce the most simple definitions possible of mass and charge, that is the TAPU definitions

$$M_T = M_*/\sqrt{h} = \sqrt{c}$$

$$Q_T = Q_*/\sqrt{h} = 1/\sqrt{c}$$

$$L_T = L_*/\sqrt{h} = \sqrt{c^{-3}}$$

and to show their simple relationships to all other properties through a new ratio $\vartheta = \sqrt{c/d} = \sqrt{2\pi c/\alpha}$.

The base formulae are now:

$$1 = M_T c\ L_T \qquad (10)$$

and

$$F_T L_T^2 = M_T^2 = Q_T^2 c^2 = c \qquad (11)$$

It is now considered here what it means to have those properties, also described as parameters, as ratios of ϑ.

The starting point is to consider how each of the parameters could be most simply described in terms of the product the normal length, velocity and time parameters (L*v*T) and respectively ϑ^1 (mass *m*) and ϑ^{-1} (charge *q*) parameters. This is done to understand better what the electromagnetic properties represent when considered as mechanical properties. This analysis is the reversal of the way that the description of the properties was parameterised into powers of *c* and *d*, and now ϑ.

The new TAPU sets are based around the X_T set $M_T = \sqrt{c}$ and $Q_T = 1/\sqrt{c}$ and the X_{eT} set $m_{eT} = \sqrt{c/d} = \vartheta^1$ and $q_{eT} = \sqrt{d/c} = \vartheta^{-1}$.

It is also worth noting how the current equation relating energy and time, instead of position and momentum in the original Heisenberg relationship [11], in DAPU was $E_* T_* = h$ and now becomes $E_T T_T = 1$ in TAPU.

XVII. COMPARISONS AND UNIT FOUNDATIONS

Tables 1 and 2 should be compared with table 4 for understanding. The q_{eT} set is the observable set of TAPU parameters which can be compared with the maximal Q_T TAPU set. Although the Q_T set is described as maximal because it is based on all adjusted Planck unit sizes, it does contain smaller values when ϑ takes positive powers.

Note that the L*v*T groups used may not correspond to the normally accepted set due to the inclusion of *m* or *q* in every parameter formula.

It is clear from a comparison of table 4 columns 1-3 and 4-6 that the same grouping of L*v*T parameters with mass *m* and with the product *qc* can be described identically. The two sets have the same powers of ϑ which should make the properties the same. So, for example, Shear Viscosity (η) and Electric Field (ξ) appear to be the same properties, and Acceleration (*a*) seems equivalent to Magnetic Inductance (*B*).

The accepted definitions of the electromagnetic properties are therefore shown to be incorrect. They should all be adjusted by the extra *c* factor.

One difficulty in considering the alignments across all possible powers of ϑ is that there are gaps where no known properties exist for that power of ϑ, at powers ϑ^{15} and ϑ^{-8}.

These gaps are properties that we have not yet realised actually exist. Doubtless they will be uncovered experimentally in due course, although it is not clear what set of parameters or units would best describe them since there are many different ways to produce their dimensionalities. The simplest set has been used in table 4.

The best possible descriptions for these two properties would be: for the ϑ^{15} property 'Kinetic Intensity' since it can be formed from the product of velocity and intensity and for the ϑ^{-8} property 'Inverse Force'.

XVIII. BRAND NEW SI UNITS

In translating between DAPU units used above in tables 1 and 2 and TAPU units used in table 5, it is helpful to show the adjustments to each of the properties in the parameter sets. The results are displayed in table 5 which combines the two parameter sets and shows both the BNSI values of the TAPU parameters and their values in terms of ratios of *c*, or of *c* and $d = \sqrt{\alpha / 2\pi}$ or $\vartheta = \sqrt{c / d}$.

The changes can be split into six groupings, where X_T / X_* is the relationship between the TAPU units in BNSI and the DAPU units in NSI when eliminating *h* content with the description of the units in table 5 given as BNSI units (*h*-adjusted).

The parameters Mass (*m*), Magnetic Flux (ϕ) , Charge-mass (*qc*), Momentum (*mv*), Energy (*E*), Temperature (*K*), Charge (*q*), Distance (*L*), Inductance $(\angle)$, Capacitance (*C*) and Time (*T*) change in the form $X_T = X_* / \sqrt{h}$.

The parameters Angular Frequency (*w*), Frequency (*f*), Acceleration (*a*), Magnetic Inductance (*B*), Magnetic Field (*H*), Electric Field (ξ) and Viscosity (η) change in the form $X_T = X_* \sqrt{h}$.

The parameters Velocity (*v*), Resistance (*R*), Current (i) , Action (*m/L*), Potential Difference (∇) , Force (*F*), Power (*P*), Conductance (ς) and Permittivity (ε) remain in the form $X_T = X_*$.

The parameters Moment (*mL*), and Area (*A*) change in the form $X_T = X_* / h$.

The parameters Mass Density (ρ) , Current Density (*J*), Pressure (*p*) and Energy Density (ψ) change in the form $X_T = X_* h$. The parameter Volume (*V*) changes in the form $X_T = X_* / h^{3/2}$.

XIX. DISCUSSION

Why is the action of charge so strong compared with gravity? The answer is that the strength of action of both is identical. It is the relative sizes in which each occur that starts the confusion and then the gravitational constant that hides the situation further. The latter is caused by the inconsistencies in SI units and lack of understanding of the underlying deeper dimensions in nature.

On the subject of the TAPU interpretation of properties what, for example, does it mean that the maximal value of the TAPU of observable adjusted-Planck unit energy is ϑ^5 whilst that of mass is ϑ^1 ?

This tells us that regardless of the relative size of the electronic charge in the q_{eT} set to its maximum value in the Q_T set, the relationship between the maximal values of the two adjusted-Planck unit properties energy and mass in terms of one being the fifth power of the other will always be the same, only the actual measurable value in whatever units are used will differ, dependent on the value of α . The laws of nature would be constructed in the same way regardless of the relative sizes of *G*, *h*, *c* and α .

It is also possible to infer that the underlying reason for the value of the fine structure constant must be motional, since it is part of the ratio $\vartheta = \sqrt{2\pi c / \alpha}$. Because the relationship is inverse, it does not necessarily mean that α is a translational velocity, instead it could be linked to rotational or spinning motion.

The total dimensionality of any object is based on the observation that there must be at least 16 + 9 + 1 = 26 dimensions existing to accommodate all the properties that we currently observe, even if we do not have names for either the mechanical or electromagnetic properties at some values of powers of ϑ , where they have not yet been recognized to exist.

Note that, other than for *m* and *q* parameters, the formulae used to provide the appropriate powers of ϑ for each parameter in table 4 do not use the target parameter in the formula, so velocity *v* does not have *v* in its formula, for example.

It is now clear that the use of *h*, *G* and the omission of the $\sqrt{1 \times 10^7}$ and 6.501 factors in SI units serve to hide the underlying symmetry within the current set of Planck units. Only in their final TAPU form in BNSI units is it clear that the set of TAPU units have adjusted-Planck unit property values {TAPU} = Y^x with $14 \geq x \geq -9$ where for the larger set $Y = \sqrt{c}$, with the smaller set having $Y = \sqrt{2\pi c / \alpha}$.

Whilst the elimination of *h* and *G* provides advantages in terms of simplification of units and improved understanding of how properties are related, it undermines the idea that the quantum realm belongs to small distances and small masses, and that the classical relativistic world belongs to large distances and large masses.

Since the paper shows that there is no difference in field strengths for identical fractional Planck values of mass and gravity, it asks the question why quantum effects are seen in the world of the small and not in the world of the large. The answer appears to be that nature prefers to balance out the larger effects first. So the naturally occurring fractional Planck size of charge is significantly larger than the normal fractional Planck size of mass of any of the basic building blocks of matter. The preference is to reduce the effect of charge first, even though this may increase the amount of mass. The primary example is the neutralising of the charges on a proton and electron to form a neutron. The existence of positive and negative units of charge enables the balancing.

So as the mass size of grouping particles increases towards equality with the field strength of a unit of charge on these masses, the existence of unitised positive and negative charges allows the net charge effect to become the easier one to balance. The attractive-only gravitational field then becomes the stronger overall as mass increases, but has no ability to balance because there is no negative gravitational effect.

So below a certain size of mass, unitised and balanceable systems will exist, where gravity plays a subsidiary role – even though its field strength is the same as that of charge its actual strength is much smaller. Above a certain size of mass, gravity will dominate because its actual strength then exceeds that of individual charges.

This does not mean that charge fields do not play a role in gravitational systems, nor that gravity does not act in charge balanced systems, only that the relative effect will be small at either end of the scale.

There ought to exist at the size where the two forces balance in actual strength, some systems where the gravity and charge actions both need to be considered equally in their dynamics.

The final output in table 5 is to display all the Q_T property set as powers of only $\sqrt{c}$ and all the q_{eT} property set as powers of only $\sqrt{2\pi c/\alpha}$. This highlights how the adjusted-Planck sized properties are linked and dependent and shows that the laws of nature would be constructed in the same way regardless of the relative sizes of *G*, *h*, *c* and α .

The dimensional analysis enables new laws to be constructed and new constants of nature to be uncovered, although it is not clear that there are any of the latter needed since *c* is all that is required to generate all the Q_T fundamental property set. However, since *c* is not strictly a fundamental constant, have dimensionality Y^2, the local value of the maximal adjusted-Planck properties will depend on the local value of *c*.

XX. CONCLUSIONS

This paper presents new ways of understanding the relationships between properties whilst undermining the current interpretation of where the quantum and classical worlds diverge because the strength of gravitational and charge fields are equivalent. The novel insights and predictions include:

i. If our current units are simplified and corrected for two misalignments, the underlying symmetry of the maximal values of all properties can be seen.

ii. The reinterpretation of *h* and *G* implies that size and distance are not the properties which separate quantum and classical gravitational systems.

iii. The reinterpretation of the gravitational constant *G* as a dimensionless ratio and its relegation from gravitational to permeability use as a ratio enables it to represent a measure of the strength of interactions within materials not between masses.

iv. The reinterpretation of *G* eliminates the need to test the equivalence of gravitational and inertial masses.

v. The strength of equal fractional adjusted-Planck sized charge and gravitational fields has been shown to be equal.

vi. The fundamental constants *h* and *G* have zero values for dimensionality and can be eliminated from all equations by appropriate adjustment of SI units because they are only dimensionless ratios.

vii. The adjustment of SI units results in the same units for magnetic inductance B_ and magnetic field H_, separated only by the dimensionless ratio $\sqrt{|G|}$ which replaces permeability. For electric field $\xi\_$ and electric displacement field D_ the relationship is the permittivity $\varepsilon\_$ equal to c^{-2} in TAPU units, meaning D_ is an energy property.

viii. To correctly understand the relationships between properties the fundamental constant *G* needs to be split equally between both mass and distance properties and *h* equally between both mass and charge properties on the one hand and distance on the other.

ix. There is a self-contained and consistent new Planck unit set of maximal Q_T based properties from which all observed values can be produced and easily combined in equations.

x. There is a self-contained and consistent new Planck unit set of electron charge-size q_{eT} based properties can be produced, some of which are directly observable in experiments.

xi. All properties can be displayed in terms of only *c* for the Q_T property set and in terms of only *c* and α for the q_{eT} set (other than permeability, permittivity, *H* and other material properties which have $|G|$ content), which was previously considered impossible.

xii. There exists a new hypothetical dimensionality analysis that can be used to describe adjusted-Planck unit property dimensions and to uncover any law of nature or any universal constants.

xiii. All that is required to produce a law of nature is to create an equation where the adjusted-Planck unit dimensionalities are equal on both sides.

xiv. To produce a constant of nature, aside from *c*, the minimum that is required is that it has Y^0 dimensionality.

xv. That most of the Q_T and q_{eT} property sets can be described solely in terms of ratios of the R_k and K_j (and *d* for the Q_T set) and so will benefit from the precision of measurement of these two properties.

xvi. That the experimentally observed value of R_k probably implies that a minimum electron velocity is required in order to pass through resistive materials.

xvii. That most electromagnetic properties can be reinterpreted in terms of mechanical properties. It requires a complete reinterpretation of what is understood by the terms magnetic inductance (acceleration), magnetic flux (mass), inductance (distance), current density (mass density) and other electromagnetic properties. One possible experimental verification exists in equating viscosity and electric field.

xviii. That the reinterpretation of R_k and $K_j/2$ with their current excellent precision of measurement, should enable increased accuracy in the estimation of the values of other adjusted-Planck unit properties and fundamental constants identified as novel composite functions of R_k and $K_j/2$.

xix. A universal method of discovering laws of nature that applies regardless of any stretching of property space. A unit with $q_{eT}/\ Q_T \neq \sqrt{\alpha\ /\ 2\ \pi}$ would still have the same relationships between adjusted-Planck unit properties although the numerical values of the results would be different.

xx. Physics can be better understood when stripped to its bare essentials using a better tool set consisting of a repaired system of SI units, which are currently misaligned across the electromagnetic and mechanical properties. By adjusting SI units to be self-consistent and consistent with TAPU units, greater clarity will ensue.

xxi. The adjustments necessary to align and make SI units self-consistent and also consistent with the simplicity of TAPU units have been proposed, producing a system of Brand New SI units.

xxii. The new dimensional analysis shows that the current set of properties is missing two from the set, whose dimensions and probable units can be inferred and are suggested be called ‘Kinetic Intensity’ and ‘Inverse Force’.

APPENDIX A. REFERENCES

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Table 1. Values of the Q_* set of properties

Property X_*	Q_* DAPU set's NSI Value	NSI Units	DAPU equivalent	As Constants
Gravitational Constant G	none	$m^3 kg^{-1} s^{-2}$	none	none
Permeability u_*	$\sqrt{6.67428\times10^{-11}}$	$N\ A^{-2}$	none	$\sqrt{\lvert G\rvert}$
Boltzmann's Constant k_B	none	$J\ K_\wedge^{-1}$	none	none
Angular Momentum h	6.62606896×10^{-34}	$J\ s$	$m^2 kg\ s^{-1}$	h
Mass M_*	4.45695580×10^{-13}	kg	kg	$\sqrt{hc}$
Magnetic Flux ϕ_*	4.45695580×10^{-13}	$W_\wedge$	$\sqrt{mkg}\, m\, s^{-1}$	$\sqrt{hc}$
Charge-mass Q_*c	4.45695580×10^{-13}	$C_\wedge m\ s^{-1}$	$\sqrt{mkg}\, m\, s^{-1}$	$\sqrt{hc}$
Velocity v_*	2.99792458×10^{8}	$m\ s^{-1}$	$m\ s^{-1}$	c
Resistance R_*	2.99792458×10^{8}	$\Omega_\wedge$	$m\ s^{-1}$	c
Momentum M_*v_*	1.33616173×10^{-4}	$m\ kg\ s^{-1}$	$m\ kg\ s^{-1}$	$c\sqrt{hc}$
Current i_*	8.98755179×10^{16}	$A_\wedge$	$\sqrt{mkg}\, s^{-1}$	c^2
Action M_*/L_*	8.98755179×10^{16}	$m^{-1}kg$	$m^{-1}kg$	c^2
Angular Frequency w_*	6.04538246×10^{37}	Hz	s^{-1}	$c^2\sqrt{c/h}$
Frequency f_*	6.04538246×10^{37}	Hz	s^{-1}	$c^2\sqrt{c/h}$
Energy E_*	4.00571211×10^{4}	J	$m^2 kg\ s^{-2}$	$c^2\sqrt{hc}$
Temperature K_*	4.00571211×10^{4}	$K_\wedge$	$K_\wedge$	$c^2\sqrt{hc}$
Potential Difference ∇_*	2.69440024×10^{25}	$\nabla_\wedge$	$\sqrt{mkg}\, m\, s^{-2}$	c^3
Acceleration a_*	1.81236007×10^{46}	$m\ s^{-2}$	$m\ s^{-2}$	$c^3\sqrt{c/h}$
Magnetic Inductance B_*	1.81236007×10^{46}	$A_\wedge m^{-1}$	$m\ s^{-2}$	$c^3\sqrt{c/h}$
Magnetic Field H_*	2.21841235×10^{51}	$A_\wedge m^{-1}$	$m\ s^{-2}$	$c^3\sqrt{c/h\lvert G\rvert}$
Force F_*	8.07760871×10^{33}	N	$m\ kg\ s^{-2}$	c^4
Electric Field ξ_*	5.43331879×10^{54}	$\nabla_\wedge m^{-1}$	$\sqrt{mkg}\ m^{-2} s^{-2}$	$c^4\sqrt{c/h}$
Viscosity η_*	5.43331879×10^{54}	$P_a s$	$m^{-1}kg\ s^{-1}$	$c^4\sqrt{c/h}$
Mass Density ρ_*	3.65466491×10^{75}	$kg\ m^{-3}$	$kg\ m^{-3}$	c^5/h
Current Density J_*	3.65466491×10^{75}	$A_\wedge m^{-2}$	$\sqrt{mkg}\ m^{-2} s^{-1}$	c^5/h
Power P_*	2.42160617×10^{42}	$J\ s^{-1}$	$m^2 kg\ s^{-3}$	c^5
Pressure p_*	3.28464901×10^{92}	$N\ m^{-2}$	$m^{-1}kg\ s^{-2}$	c^7/h
Energy Density ψ_*	3.28464901×10^{92}	$J\ m^{-3}$	$m^{-1}kg\ s^{-2}$	c^7/h
Charge Q_*	1.48668043×10^{-21}	$C_\wedge$	$\sqrt{mkg}$	$\sqrt{h/c}$
Conductance ς_*	3.33564095×10^{-9}	$\Omega_\wedge^{-1}$	$m^{-1}s$	c^{-1}
Moment M_*L_*	2.21021870×10^{-42}	$m\ kg$	$m\ kg$	h/c
Distance L_*	4.95903212×10^{-30}	m	m	$c^{-1}\sqrt{h/c}$
Inductance $\angle_*$	4.95903212×10^{-30}	$H_\wedge$	$\sqrt{mkg}\ m^{-1}s^{-1}$	$c^{-1}\sqrt{h/c}$
Permittivity ε_*	1.36193501×10^{-12}	$F_\# m^{-1}$	$m^{-2}s^2$	$c^{-2}\sqrt{\lvert G\rvert}$
Time T_*	1.65415506×10^{-38}	s	s	$c^{-2}\sqrt{h/c}$
Area A_*	2.45919996×10^{-59}	m^2	m^2	h/c^3
Volume V_*	1.21952516×10^{-88}	m^3	m^3	$h\ \sqrt{h/c}/c^4$

Table 2. Values of the q_{e*} set of properties

Property X_{e*}	q_{e*} DAPU set's NSI Value	NSI Units	DAPU equivalent	As Constants
Permeability u_{e*}	$\sqrt{6.67428\times10^{-11}}$	$N\ A^{-2}$	none	$\sqrt{\lvert G\rvert}$
Boltzmann's Constant k_B	none	$J\ K_\wedge^{-1}$	none	none
Angular Momentum h	6.62606896×10^{-34}	$J\ s$	$m^2 kg\ s^{-1}$	h
Mass m_{e*}	1.30781284×10^{-11}	kg	kg	$d^{-1}\sqrt{hc}$
Magnetic Flux ϕ_{e*}	1.30781284×10^{-11}	$W_\wedge$	$\sqrt{mkg}\,m\,s^{-1}$	$d^{-1}\sqrt{hc}$
Charge-mass $q_{e*}c$	1.30781284×10^{-11}	$C_\wedge m\ s^{-1}$	$\sqrt{mkg}\,m\,s^{-1}$	$d^{-1}\sqrt{hc}$
Velocity v_{e*}	2.58128076×10^{11}	$m\ s^{-1}$	$m\ s^{-1}$	$d^{-2}c$
Resistance R_{e*}	2.58128076×10^{11}	$\Omega_\wedge$	$m\ s^{-1}$	$d^{-2}c$
Momentum $m_{e*}v_{e*}$	3.37583212×10^{00}	$m\ kg\ s^{-1}$	$m\ kg\ s^{-1}$	$d^{-3}c\sqrt{hc}$
Current i_{e*}	6.66301034×10^{22}	$A_\wedge$	$\sqrt{mkg}\ s^{-1}$	$d^{-4}c^2$
Action m_{e*}/L_{e*}	6.66301034×10^{22}	$m^{-1}kg$	$m^{-1}kg$	$d^{-4}c^2$
Angular Frequency w_{e*}	1.31510410×10^{45}	Hz	s^{-1}	$d^{-5}c^2\sqrt{c/h}$
Frequency f_{e*}	1.31510410×10^{45}	Hz	s^{-1}	$d^{-5}c^2\sqrt{c/h}$
Energy E_{e*}	8.71397049×10^{11}	J	$m^2 kg\ s^{-2}$	$d^{-5}c^2\sqrt{hc}$
Temperature K_{e*}	8.71397049×10^{11}	$K_\wedge$	$K_\wedge$	$d^{-5}c^2\sqrt{hc}$
Potential Difference ∇_{e*}	1.71991004×10^{34}	$\nabla_\wedge$	$\sqrt{mkg}\,m\,s^{-2}$	$d^{-6}c^3$
Acceleration a_{e*}	3.39465292×10^{56}	$m\ s^{-2}$	$m\ s^{-2}$	$d^{-7}c^3\sqrt{c/h}$
Magnetic Inductance B_{e*}	3.39465292×10^{56}	$A_\wedge m^{-1}$	$m\ s^{-2}$	$d^{-7}c^3\sqrt{c/h}$
Magnetic Field H_{e*}	4.15521180×10^{61}	$A_\wedge m^{-1}$	$m\ s^{-2}$	$d^{-7}c^3\sqrt{c/h\lvert G\rvert}$
Force F_{e*}	4.43957068×10^{45}	N	$m\ kg\ s^{-2}$	$d^{-8}c^4$
Electric Field ξ_{e*}	8.76255225×10^{67}	$\nabla_\wedge m^{-1}$	$\sqrt{mkg}\,m^{-2}s^{-2}$	$d^{-9}c^4\sqrt{c/h}$
Viscosity η_{e*}	8.76255225×10^{67}	$P_a s$	$m^{-1}kg\ s^{-1}$	$d^{-9}c^4\sqrt{c/h}$
Mass Density ρ_{e*}	1.72949881×10^{90}	$kg\ m^{-3}$	$kg\ m^{-3}$	$d^{-10}c^5/h$
Current Density J_{e*}	1.72949881×10^{90}	$A_\wedge m^{-2}$	$\sqrt{mkg}\,m^{-2}s^{-1}$	$d^{-10}c^5/h$
Power P_{e*}	1.14597784×10^{57}	$J\ s^{-1}$	$m^2 kg\ s^{-3}$	$d^{-10}c^5$
Pressure p_{e*}	1.15236684×10^{113}	$N\ m^{-2}$	$m^{-1}kg\ s^{-2}$	$d^{-14}c^7/h$
Energy Density ψ_{e*}	1.15236684×10^{113}	$J\ m^{-3}$	$m^{-1}kg\ s^{-2}$	$d^{-14}c^7/h$
Charge q_{e*}	5.06652691×10^{-23}	$C_\wedge$	$\sqrt{mkg}$	$d\sqrt{h/c}$
Conductance ς_{e*}	3.87404585×10^{-12}	$\Omega_\wedge^{-1}$	$m^{-1}s$	d^2c^{-1}
Moment $m_{e*}L_{e*}$	2.56696950×10^{-45}	$m\ kg$	$m\ kg$	d^2h/c
Distance L_{e*}	1.96279576×10^{-34}	m	m	$c^{-1}\sqrt{h/c}$
Inductance $\angle_{e*}$	1.96279576×10^{-34}	$H_\wedge$	$\sqrt{mkg}\,m^{-1}s^{-1}$	$d^3c^{-1}\sqrt{h/c}$
Permittivity ε_{e*}	1.83707675×10^{-18}	$F_\# m^{-1}$	$m^{-2}s^2$	$d^4c^{-2}\sqrt{\lvert G\rvert}$
Time T_{e*}	7.60396075×10^{-46}	s	s	$d^5c^{-2}\sqrt{h/c}$
Area A_{e*}	3.85256718×10^{-68}	m^2	m^2	d^6h/c^3
Capacitance C_{e*}	2.94580926×10^{-57}	$F_\#$	$m^{-1}s^2$	$d^7c^{-3}\sqrt{h/c}$
Volume V_{e*}	$7.56180251\times10^{-102}$	m^3	m^3	$d^9h\sqrt{h/c}/c^4$

Table 3. How to translate between SI and DAPU NSI units

Property NSI	Property	DAPU value	DAPU factor X_*	SI value for Planck unit	SI Name
6.62606896×10^{-34}	h	h	2π	1.0545716×10^{-34}	$\hbar$
4.45695580×10^{-13}	M_*	$\sqrt{hc}$	$\sqrt{2\pi G}$	2.1764374×10^{-8}	M_{planck}
1.48668043×10^{-21}	Q_*	$\sqrt{h/c}$	$\sqrt{1\times10^{-7}}$	4.7012963×10^{-18}	Q_{planck}
5.06652691×10^{-23}	q_{e*}	$\sqrt{\alpha/2\pi}\sqrt{h/c}$	$\sqrt{1\times10^{-7}}$	1.6021765×10^{-19}	e
4.95903212×10^{-30}	L_*	$\sqrt{h/c^3}$	$\sqrt{2\pi/G}$	1.6162525×10^{-35}	L_{planck}
none	G	none	none	6.67428×10^{-11}	G
2.99792458×10^{8}	c	c	1	2.99792458×10^{8}	c
2.58128076×10^{11}	R_{e*}	$2\pi c/\alpha$	1×10^{7}	2.58128076×10^{4}	R_k
1.52927081×10^{11}	$2/\phi_{e*}$	$2\sqrt{\alpha/(2\pi hc)}$	$\sqrt{1\times10^{-7}}$	4.83597891×10^{14}	K_j

Table 4. Comparison of the parameterisation of properties at each power of ϑ

1	2	3	4	5	6	7	8	9
X_{eT} mass set as powers of ϑ	Mass Parameter (Accepted)	Mass Formula	X_{eT} *qc* set as powers of ϑ	Charge Parameter (Proposed)	Charge (*qc*) Formula	X_{eT} *q* set as powers of ϑ	Charge Parameter (Implied by grouping without *c*, but incorrect)	Charge (*q*) Formula
0	Angular Momentum	mvL	0	Magnetic moment x2/*c*	$qcvL$	-2	Magnetic moment x2	qvL
1	Mass	m	1	Magnetic Flux	qc	-1	Charge	q
2	Velocity	$m\ L^{-2}T$	2	Resistance	$qc\ L^{-2}T$	0	Resistance	$q\ L^{-2}T$
3	Momentum	mv	3	-	qcv	1	-	qv
4	Action	m/L	4	Current	qc/L	2	Current	q/L
5	Energy	$m\ v^2$	5	Energy	$qc\ v^2$	3	Energy	$q\ v^2$
6	-	mv/L	6	Potential Difference	qcv/L	4	Potential Difference	qv/L
7	Acceleration	$m\ L^{-2}$	7	Magnetic Inductance	$qc\ L^{-2}$	5	Magnetic Inductance	$q\ L^{-2}$
7	Acceleration	$m\ L^{-2}$	7	Magnetic Field	$qc\ L^{-2}/\sqrt{\lvert G \rvert}$	5	Magnetic Field	$q\ L^{-2}/\sqrt{\lvert G \rvert}$
8	Force	$m\ v^2/L$	8	Force	$qc\ v^2/L$	6	Force	$q\ v^2/L$
9	Shear Viscosity	$m\ v\ L^{-2}$	9	Electric Field	$qc\ v\ L^{-2}$	7	Electric Field	$q\ v\ L^{-2}$
10	Mass Density	$m\ L^{-3}$	10	Current Density	$qc\ L^{-3}$	8	Current Density	$q\ L^{-3}$
11	Luminance	$m\ T^{-2}$	11	-	$qc\ T^{-2}$	9	-	$q\ T^{-2}$
12	Kinetic viscosity	$m\ v\ L^{-3}$	12	-	$qc\ v\ L^{-3}$	10	-	$q\ v\ L^{-3}$
13	Intensity	$m\ v\ T^{-2}$	13	-	$qc\ v\ T^{-2}$	11	-	$q\ v\ T^{-2}$
14	Pressure	$m\ v^2 L^{-3}$	14	-	$qc\ v^2 L^{-3}$	12	-	$q\ v^2 L^{-3}$
15	**Undiscovered**	$m\ v^2 T^{-2}$	15	**Undiscovered**	$qc\ v^2 T^{-2}$	13	-	$q\ v^2 T^{-2}$
16	Radiance	$m\ T^{-3}$	16	-	$qc\ T^{-3}$	14	-	$q\ T^{-3}$
-1	-	m/v	-1	Charge mass	qc/v	-3	-	q/v
-2	Moment	mL	-2	Conductance	qcL	-4	Conductance	qL
-3	Distance	$m\ /v^2$	-3	Inductance	$qc\ /v^2$	-5	Inductance	$q\ /v^2$
-4	-	mT	-4	Permittivity	$qcT/\sqrt{\lvert G \rvert}$	-6	Permittivity	$qT/\sqrt{\lvert G \rvert}$
-5	Time	$m\ L^2$	-5	Time	$qc\ L^2$	-7	Time	$q\ L^2$
-6	Area	mT/v	-6	Area	qcT/v	-8	Area	qT/v
-7	-	mTL	-7	Capacitance	$qcTL$	-9	Capacitance	qTL
-8	**Undiscovered**	$m\ L^3$	-8	**Undiscovered**	$qc\ L^3$	-10	-	$q\ L^3$
-9	Volume	mTL/v	-9	Volume	$qcTL/v$	-11	Volume	qTL/v

Table 5. Values of parameters in BNSI, ratios of c and d and powers of ϑ

Parameter X_{-}	X_T TAPU set's BNSI Value	X_{eT} TAPU set's BNSI Value	X_T as Constants	X_{eT} as Constants	BNSI Units (h-adjusted)	X_{eT} set as powers of ϑ
Permeability u_{-}	$\sqrt{6.67428\times10^{-11}}$	$\sqrt{6.67428\times10^{-11}}$	$\sqrt{\lvert G\rvert}$	$\sqrt{\lvert G\rvert}$	$N\ A^{-2}$	ϑ^{0}
Boltzmann's Constant k_B	none	none	none	none	$J\ K_{\wedge}^{-1}$	ϑ^{0}
Angular Momentum h	none	none	none	none	$J\ s$	ϑ^{0}
Mass M_{-}	1.73145158×10^{04}	5.08063063×10^{5}	$(\sqrt{c})^{1}$	$d^{-1}(\sqrt{c})^{1}$	kg	ϑ^{1}
Magnetic Flux ϕ_{-}	1.73145158×10^{04}	5.08063063×10^{5}	$(\sqrt{c})^{1}$	$d^{-1}(\sqrt{c})^{1}$	$W_{\wedge}$	ϑ^{1}
Charge-mass Q_{-c}	1.73145158×10^{04}	5.08063063×10^{5}	$(\sqrt{c})^{1}$	$d^{-1}(\sqrt{c})^{1}$	$C_{\wedge}m\ s^{-1}$	ϑ^{1}
Velocity v_{-}	2.99792458×10^{08}	2.58128076×10^{11}	$(\sqrt{c})^{2}$	$d^{-2}(\sqrt{c})^{2}$	$m\ s^{-1}$	ϑ^{2}
Resistance R_{-}	2.99792458×10^{08}	2.58128076×10^{11}	$(\sqrt{c})^{2}$	$d^{-2}(\sqrt{c})^{2}$	$\Omega_{\wedge}$	ϑ^{2}
Momentum $M_{-}v_{-}$	5.19076126×10^{12}	1.31145341×10^{17}	$(\sqrt{c})^{3}$	$d^{-3}(\sqrt{c})^{3}$	$m\ kg\ s^{-1}$	ϑ^{3}
Current i_{-}	8.98755179×10^{16}	6.66301034×10^{22}	$(\sqrt{c})^{4}$	$d^{-4}(\sqrt{c})^{4}$	$A_{\wedge}$	ϑ^{4}
Action M_{-}/L_{-}	8.98755179×10^{16}	6.66301034×10^{22}	$(\sqrt{c})^{4}$	$d^{-4}(\sqrt{c})^{4}$	$m^{-1}kg$	ϑ^{4}
Angular Frequency w_{-}	1.55615108×10^{21}	3.38522944×10^{28}	$(\sqrt{c})^{5}$	$d^{-5}(\sqrt{c})^{5}$	Hz	ϑ^{5}
Frequency f_{-}	1.55615108×10^{21}	3.38522944×10^{28}	$(\sqrt{c})^{5}$	$d^{-5}(\sqrt{c})^{5}$	Hz	ϑ^{5}
Energy E_{-}	1.55615108×10^{21}	3.38522944×10^{28}	$(\sqrt{c})^{5}$	$d^{-5}(\sqrt{c})^{5}$	J	ϑ^{5}
Temperature K_{-}	1.55615108×10^{21}	3.38522944×10^{28}	$(\sqrt{c})^{5}$	$d^{-5}(\sqrt{c})^{5}$	$K_{\wedge}$	ϑ^{5}
Potential Difference ∇_{-}	2.69440024×10^{25}	1.71991004×10^{34}	$(\sqrt{c})^{6}$	$d^{-6}(\sqrt{c})^{6}$	$\nabla_{\wedge}$	ϑ^{6}
Acceleration a_{-}	4.66522356×10^{29}	8.73822761×10^{39}	$(\sqrt{c})^{7}$	$d^{-7}(\sqrt{c})^{7}$	$m\ s^{-2}$	ϑ^{7}
Magnetic Inductance B_{-}	4.66522356×10^{29}	8.73822761×10^{39}	$(\sqrt{c})^{7}$	$d^{-7}(\sqrt{c})^{7}$	$A_{\wedge}m^{-1}$	ϑ^{7}
Magnetic Field H_{-}	5.71044889×10^{34}	1.06959938×10^{45}	$(\sqrt{c})^{7}/\sqrt{\lvert G\rvert}$	$d^{-7}(\sqrt{c})^{7}/\sqrt{\lvert G\rvert}$	$A_{\wedge}m^{-1}$	$\vartheta^{7}/\sqrt{\lvert G\rvert}$
Force F_{-}	8.07760871×10^{33}	4.43957068×10^{45}	$(\sqrt{c})^{8}$	$d^{-8}(\sqrt{c})^{8}$	N	ϑ^{8}
Electric Field ξ_{-}	1.39859884×10^{38}	2.25558188×10^{51}	$(\sqrt{c})^{9}$	$d^{-9}(\sqrt{c})^{9}$	$\nabla_{\wedge}m^{-1}$	ϑ^{9}
Viscosity η_{-}	1.39859884×10^{38}	2.25558188×10^{51}	$(\sqrt{c})^{9}$	$d^{-9}(\sqrt{c})^{9}$	$P_a s$	ϑ^{9}
Mass Density ρ_{-}	2.42160617×10^{42}	1.14597784×10^{57}	$(\sqrt{c})^{10}$	$d^{-10}(\sqrt{c})^{10}$	$kg\ m^{-3}$	ϑ^{10}
Current Density J_{-}	2.42160617×10^{42}	1.14597784×10^{57}	$(\sqrt{c})^{10}$	$d^{-10}(\sqrt{c})^{10}$	$A_{\wedge}m^{-2}$	ϑ^{10}
Power P_{-}	2.42160617×10^{42}	1.14597784×10^{57}	$(\sqrt{c})^{10}$	$d^{-10}(\sqrt{c})^{10}$	$J\ s^{-1}$	ϑ^{10}
Pressure p_{-}	2.17643109×10^{59}	7.63566217×10^{79}	$(\sqrt{c})^{14}$	$d^{-14}(\sqrt{c})^{14}$	$N\ m^{-2}$	ϑ^{14}
Energy Density ψ_{-}	2.17643109×10^{59}	7.63566217×10^{79}	$(\sqrt{c})^{14}$	$d^{-14}(\sqrt{c})^{14}$	$J\ m^{-3}$	ϑ^{14}
Charge Q_{-}	5.77550080×10^{-5}	1.96825960×10^{-6}	$(\sqrt{c})^{-1}$	$d^{1}(\sqrt{c})^{-1}$	$C_{\wedge}$	ϑ^{-1}
Conductance ς_{-}	3.33564095×10^{-9}	3.87404585×10^{-12}	$(\sqrt{c})^{-2}$	$d^{2}(\sqrt{c})^{-2}$	$\Omega_{\wedge}^{-1}$	ϑ^{-2}
Moment $M_{-}L_{-}$	3.33564095×10^{-9}	3.87404585×10^{-12}	$(\sqrt{c})^{-2}$	$d^{2}(\sqrt{c})^{-2}$	$m\ kg$	ϑ^{-2}
Distance L_{-}	1.92649970×10^{-13}	7.62512793×10^{-18}	$(\sqrt{c})^{-3}$	$d^{3}(\sqrt{c})^{-3}$	m	ϑ^{-3}
Inductance $\angle_{-}$	1.92649970×10^{-13}	7.62512793×10^{-18}	$(\sqrt{c})^{-3}$	$d^{3}(\sqrt{c})^{-3}$	$H_{\wedge}$	ϑ^{-3}
Permittivity ε_{-}	1.36193501×10^{-12}	1.83707675×10^{-18}	$(\sqrt{c})^{-4}/\sqrt{\lvert G\rvert}$	$d^{4}(\sqrt{c})^{-4}/\sqrt{\lvert G\rvert}$	$F_{\#}m^{-1}$	$\vartheta^{-4}/\sqrt{\lvert G\rvert}$
Time T_{-}	6.42611129×10^{-22}	2.95400952×10^{-29}	$(\sqrt{c})^{-5}$	$d^{5}(\sqrt{c})^{-5}$	s	ϑ^{-5}
Area A_{-}	3.71140109×10^{-26}	5.81425760×10^{-35}	$(\sqrt{c})^{-6}$	$d^{6}(\sqrt{c})^{-6}$	m^{2}	ϑ^{-6}
Capacitance C_{-}	2.14352000×10^{-30}	1.14439683×10^{-40}	$(\sqrt{c})^{-7}$	$d^{7}(\sqrt{c})^{-7}$	$F_{\#}$	ϑ^{-7}
Volume V_{-}	7.15001309×10^{-39}	4.43344580×10^{-52}	$(\sqrt{c})^{-9}$	$d^{9}(\sqrt{c})^{-9}$	m^{3}	ϑ^{-9}