How Simple Quantity Tables Elucidate the Digital Analog Question

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This essay analyzes the dimensions of the physical quantities. Planck units are used as identifyers of the physical quantities. Quantity tables reveal interesting patterns like alternating scalar and vector quantities. This essay advocates that Nature is fundamentally continuous and that phase is responsible for the fact that certain physical quantities can take only a countable set of discrete values. The introduction of phase leads from a relativistic classical mechanics to a relativistic quantum mechanics. In a somewhat broken analogy we can say that continuous media like water or gas also produce discrete physical objects like dropplets and bubbles. Interesting is the finding of a quadratic metric as the very essence of the Maxwell equations. If we 'throw' this pure electromagnetic metric into the pure gravitomagnetic metric then the result are the Maxwell equations. Also interesting is the finding that the fine structure constant is the ratio of two different planck constants. Because of the introduction of new quantities I often use the names of the quantities in stead of their symbols.

A. Is Reality Digital or Analog?

E = electric fieldstrength, H = magnetic fieldstrength, D = dieëlectric displacement, B = Magnetic induction, ρ = electric charge density, q = electric charge, A = vector potential, ϕ = scalar potential, K = Coulomb constant, ϵ = electric permitivity, μ = magnetic permeability, Φ_m = magnetic flux, Ψe = electric flux, v = velocity, L = length, t = time, f = gravitomagnetic flux, b = burst, E = energy, p = momentum, m = mass, s = string

Physical quantities can be put into quantity tables. SI derived units can be put into at least 7 different tables. Every cell in a table has it's own planck unit. Planck units are great identifiers for physical quantities. In all 7 tables cells to the left have their *spatial* dimension $\sqrt{h^1G^1c^{-3}}$ lowered by one and cells diagonally left downwards have their *time* dimension $\sqrt{h^1G^1c^{-5}}$ lowered by one. Two groups: A group of three tables involving *gravitomagnetic quantities*. Those quantities are refered to as belonging to the *gravitomagnetic system*. They are coloured blue. And a group of four tables involving *electromagnetic quantities*. Those quantities are refered to as belonging to the *electromagnetic system*. There are only two pure electromagnetic quantities: electromagnetic flux and electric charge. Both are coloured red. Most quantities of the electromagnetic system are mixed quantities and they have two colours: blue and red. There are pure quantities, and there are also mixed quantities. If we filter away the gravitomagnetic componends from the electromagnetic mixed quantities then there only remains two pure quantities em-flux en electric charge. The naming of some quantities is in analogy to quantities in other tables. For example The gravitomagnetic vector potential is in analogy with the (electro-)magnetic vector potential. All quantities are derivations of some basal quantities. There are just a few basal quantities: time, length, mass and electric charge. All derived quantities are combinations of a basal quantity together with length and/or time. Because time is a scalar quantity and length is a vector quantity, therefore in the quantity tables an alternating pattern of scalar and vector quantities shows up. We call all those quantities *primary* physical quantities. This because to discriminate them from *secondary* physical quantities. Secondary physical quantities are exceptions to this alternating pattern. For example vorticity is a vector quantity. But the cell in which it resides is primary a scalar quantity. The same is truth for the magnetic field B (also called magnetic induction). The magnetic field also is a vector quantity. But the cell in which it resides is primary a scalar quantity. Interesting is that vorticity and the magnetic field are both pseudovectors. The same is truth for angular momentum.

Therefore I think it is really important that if we try to understand the relations between physical quantities that in the equations, we stick to those primary quantities. For example in the Maxwell equations in stead of the magnetic field B we use magnetic fieldstrength H. Below we will see that the very essence of the Maxwell equations is a quadratic metric.

We can ask if there is an overall relationship between all those different quantities in the quantity tables. Yes there is. First we explore the constants of nature: speed of light c, gravitational constant G and Coulomb constant K. All three of them are ratios of the other quantities. The dimension of the speed of light c can be expressed in different

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FIG. 1: Length table $kg^0 A^0 m^x s^y$.

→ $\sqrt{h^{-2} G^{-2} c^{4}}$	· $\sqrt{h^{-1} G^{-1} c^{1}}$	→ $\sqrt{h^{0} G^{0} c^{-2}}$	· $\sqrt{h^{1} G^{1} c^{-5}}$ time	→ $\sqrt{h^{2} G^{2} c^{-8}}$
· $\sqrt{h^{-2} G^{-2} c^{6}}$ laplace operator Δ	→ $\sqrt{h^{-1} G^{-1} c^{3}}$ del operator ∇	· $\sqrt{h^{0} G^{0} c^{0}}$	→ $\sqrt{h^{1} G^{1} c^{-3}}$ length	· $\sqrt{h^{2} G^{2} c^{-6}}$ surface area
→ $\sqrt{h^{-2} G^{-2} c^{8}}$	· $\sqrt{h^{-1} G^{-1} c^{5}}$ strain rate gravitomagnetic induction vorticity	→ $\sqrt{h^{0} G^{0} c^{2}}$ velocity gravitomagnetic vector potential	· $\sqrt{h^{1} G^{1} c^{-1}}$ gravitomagnetic flux kinematic viscosity	→ $\sqrt{h^{2} G^{2} c^{-4}}$ volumetric flow rate
· $\sqrt{h^{-2} G^{-2} c^{10}}$	→ $\sqrt{h^{-1} G^{-1} c^{7}}$ gravitational fieldstrength acceleration	· $\sqrt{h^{0} G^{0} c^{4}}$ gravitational scalar potential	→ $\sqrt{h^{1} G^{1} c^{1}}$ burst	· $\sqrt{h^{2} G^{2} c^{-2}}$
→ $\sqrt{h^{-2} G^{-2} c^{12}}$ jerk	· $\sqrt{h^{-1} G^{-1} c^{9}}$	→ $\sqrt{h^{0} G^{0} c^{6}}$	· $\sqrt{h^{1} G^{1} c^{3}}$ valention	→ $\sqrt{h^{2} G^{2} c^{0}}$

FIG. 2: Mass table $kg^1 A^0 m^x s^y$.

→ $\sqrt{h^{-2} G^{-4} c^{6}}$	· $\sqrt{h^{-1} G^{-3} c^{3}}$	→ $\sqrt{h^{0} G^{-2} c^{0}}$ gravitational permittivity	· $\sqrt{h^{1} G^{-1} c^{-3}}$ instant	→ $\sqrt{h^{2} G^{0} c^{-6}}$
· $\sqrt{h^{-2} G^{-4} c^{8}}$	→ $\sqrt{h^{-1} G^{-3} c^{5}}$	· $\sqrt{h^{0} G^{-2} c^{2}}$	→ $\sqrt{h^{1} G^{-1} c^{-1}}$ string	· $\sqrt{h^{2} G^{0} c^{-4}}$
→ $\sqrt{h^{-2} G^{-4} c^{10}}$ mass density	· $\sqrt{h^{-1} G^{-3} c^{7}}$ surface density	→ $\sqrt{h^{0} G^{-2} c^{4}}$ gravitational vector potential	· $\sqrt{h^{1} G^{-1} c^{1}}$ mass	→ $\sqrt{h^{2} G^{0} c^{-2}}$ mass-centre motion
· $\sqrt{h^{-2} G^{-4} c^{12}}$ massflow density	→ $\sqrt{h^{-1} G^{-3} c^{9}}$ gravitomagnetic fieldstrength dynamic viscosity	· $\sqrt{h^{0} G^{-2} c^{6}}$ gravitomagnetic scalar potential massflow	→ $\sqrt{h^{1} G^{-1} c^{3}}$ momentum	· $\sqrt{h^{2} G^{0} c^{0}}$ action
→ $\sqrt{h^{-2} G^{-4} c^{14}}$ pressure energy density	· $\sqrt{h^{-1} G^{-3} c^{11}}$ surface tension	→ $\sqrt{h^{0} G^{-2} c^{8}}$ force	· $\sqrt{h^{1} G^{-1} c^{5}}$ energy	→ $\sqrt{h^{2} G^{0} c^{2}}$
· $\sqrt{h^{-2} G^{-4} c^{16}}$	→ $\sqrt{h^{-1} G^{-3} c^{13}}$ yank	· $\sqrt{h^{0} G^{-2} c^{10}}$ power	→ $\sqrt{h^{1} G^{-1} c^{7}}$ quint	· $\sqrt{h^{2} G^{0} c^{4}}$

FIG. 3: Gravitational constant table $kg^{-1} A^0 m^x s^y$.

· $\sqrt{h^{-2} G^{0} c^{0}}$	→ $\sqrt{h^{-1} G^{1} c^{-3}}$	· $\sqrt{h^{0} G^{2} c^{-6}}$	→ $\sqrt{h^{1} G^{3} c^{-9}}$ fluidity	· $\sqrt{h^{2} G^{4} c^{-12}}$
→ $\sqrt{h^{-2} G^{0} c^{2}}$	· $\sqrt{h^{-1} G^{1} c^{-1}}$	→ $\sqrt{h^{0} G^{2} c^{-4}}$ gravitomagnetic permeability	· $\sqrt{h^{1} G^{3} c^{-7}}$	→ $\sqrt{h^{2} G^{4} c^{-10}}$ specific volume
· $\sqrt{h^{-2} G^{0} c^{4}}$	→ $\sqrt{h^{-1} G^{1} c^{1}}$	· $\sqrt{h^{0} G^{2} c^{-2}}$	→ $\sqrt{h^{1} G^{3} c^{-5}}$	· $\sqrt{h^{2} G^{4} c^{-8}}$
→ $\sqrt{h^{-2} G^{0} c^{6}}$	· $\sqrt{h^{-1} G^{1} c^{3}}$	→ $\sqrt{h^{0} G^{2} c^{0}}$ gravitational constant	· $\sqrt{h^{1} G^{3} c^{-3}}$	→ $\sqrt{h^{2} G^{4} c^{-6}}$

FIG. 4: Magnetic flux table $kg^0 A^{-1} m^x s^y$.

$\sqrt{h^{-2}K^{1}G^{-3}c^{6}}$	$\sqrt{h^{-1}K^{1}G^{-2}c^{3}}$	$\sqrt{h^{0}K^{1}G^{-1}c^{0}}$	$\sqrt{h^{1}K^{1}G^{0}c^{-3}}$	$\sqrt{h^{2}K^{1}G^{1}c^{-6}}$
$\sqrt{h^{-2}K^{1}G^{-3}c^{8}}$ magnetic charge density	$\sqrt{h^{-1}K^{1}G^{-2}c^{5}}$ magnetic induction magnetic flux density	$\sqrt{h^{0}K^{1}G^{-1}c^{2}}$ electromagnetic vector potential	$\sqrt{h^{1}K^{1}G^{0}c^{-1}}$ magnetic flux	$\sqrt{h^{2}K^{1}G^{1}c^{-4}}$ magnetic moment
$\sqrt{h^{-2}K^{1}G^{-3}c^{10}}$ magnetic current density	$\sqrt{h^{-1}K^{1}G^{-2}c^{7}}$ electric fieldstrength electrization	$\sqrt{h^{0}K^{1}G^{-1}c^{4}}$ magnetic current electric scalar potential	$\sqrt{h^{1}K^{1}G^{0}c^{1}}$	$\sqrt{h^{2}K^{1}G^{1}c^{-2}}$

FIG. 5: Electric charge table $kg^0 A^1 m^x s^y$.

$\sqrt{h^{-2}K^{-1}G^{-3}c^{8}}$	$\sqrt{h^{-1}K^{-1}G^{-2}c^{5}}$	$\sqrt{h^{0}K^{-1}G^{-1}c^{2}}$	$\sqrt{h^{1}K^{-1}G^{0}c^{-1}}$	$\sqrt{h^{2}K^{-1}G^{1}c^{-4}}$
$\sqrt{h^{-2}K^{-1}G^{-3}c^{10}}$ electric charge density	$\sqrt{h^{-1}K^{-1}G^{-2}c^{7}}$ surface charge density electric flux density dieëlectric displacement	$\sqrt{h^{0}K^{-1}G^{-1}c^{4}}$ electric vector potential	$\sqrt{h^{1}K^{-1}G^{0}c^{1}}$ electric charge electric flux	$\sqrt{h^{2}K^{-1}G^{1}c^{-2}}$
$\sqrt{h^{-2}K^{-1}G^{-3}c^{12}}$ current density displacement current	$\sqrt{h^{-1}K^{-1}G^{-2}c^{9}}$ magnetization magnetic fieldstrength	$\sqrt{h^{0}K^{-1}G^{-1}c^{6}}$ electric current magnetic scalar potential	$\sqrt{h^{1}K^{-1}G^{0}c^{3}}$	$\sqrt{h^{2}K^{-1}G^{1}c^{0}}$ magnetic dipole moment

ways:

$$c = \frac{\text{length}}{\text{time}}, \frac{\text{gmflux}}{\text{length}}, \frac{\text{burst}}{\text{gmflux}}, \frac{\text{momentum}}{\text{mass}}, \frac{\text{energy}}{\text{momentum}}, \frac{\text{electric field}}{\text{magnetic field}}.$$

The dimension of the gravitational constant G is also understand as a ratio. But take a look at the quantity tables to understand in which tables the quantities reside:

$$G = \frac{\text{valention}}{\text{momentum}}, \frac{\text{burst}}{\text{mass}}, \frac{\text{gmflux}}{\text{string}}, \frac{\text{length}}{\text{instant}}.$$

It is more elucidating if in stead of G we use constant G/c as a ratio:

$$G/c = \frac{\text{time}}{\text{instant}}, \frac{\text{length}}{\text{string}}, \frac{\text{gmflux}}{\text{mass}}, \frac{\text{burst}}{\text{momentum}}, \frac{\text{valention}}{\text{energy}}.$$

The gravitomagnetic equivalents of electric permittivity ϵ_0 and magnetic permeability μ_0 I will write as gravitational permittivity ϵ_g and gravitomagnetic permeability μ_g.

$$\epsilon_g = \frac{\text{instant}}{\text{length}}, \frac{\text{string}}{\text{gmflux}}, \frac{\text{mass}}{\text{burst}}.$$

$$\mu_g = \frac{\text{length}}{\text{mass}}, \frac{\text{gmflux}}{\text{momentum}}, \frac{\text{burst}}{\text{energy}}.$$

The dimension of the Coulomb constant K is also a ratio:

$$K = \frac{\text{electric scalar potential}}{\text{electric vector potential}}, \frac{\text{electric fieldstrength}}{\text{dieëlectric displacement}}.$$

FIG. 6: Electric permittivity $kg^{-1}A^2m^xs^y$.

$\sqrt{h^{-2}K^{-2}G^{-2}c^{6}}$	$\sqrt{h^{-1}K^{-2}G^{-1}c^{3}}$	$\sqrt{h^{0}K^{-2}G^{0}c^{0}}$ electric permittivity	$\sqrt{h^{1}K^{-2}G^{1}c^{-3}}$ electric capacitance	$\sqrt{h^{2}K^{-2}G^{2}c^{-6}}$
$\sqrt{h^{-2}K^{-2}G^{-2}c^{8}}$	$\sqrt{h^{-1}K^{-2}G^{-1}c^{5}}$ electrical conductivity	$\sqrt{h^{0}K^{-2}G^{0}c^{2}}$ electric admittance electric conductance	$\sqrt{h^{1}K^{-2}G^{1}c^{-1}}$	$\sqrt{h^{2}K^{-2}G^{2}c^{-4}}$
$\sqrt{h^{-2}K^{-2}G^{-2}c^{10}}$	$\sqrt{h^{-1}K^{-2}G^{-1}c^{7}}$ electric reluctance magnetic reluctance	$\sqrt{h^{0}K^{-2}G^{0}c^{4}}$ electromagnetic reluctivity	$\sqrt{h^{1}K^{-2}G^{1}c^{1}}$	$\sqrt{h^{2}K^{-2}G^{2}c^{-2}}$

FIG. 7: Magnetic permeability $kg^1A^{-2}m^xs^y$.

$\sqrt{h^{-2}K^{2}G^{-2}c^{2}}$	$\sqrt{h^{-1}K^{2}G^{-1}c^{-1}}$	$\sqrt{h^{0}K^{2}G^{0}c^{-4}}$ magnetic permeability	$\sqrt{h^{1}K^{2}G^{1}c^{-7}}$ electric inductance magnetic permeance	$\sqrt{h^{2}K^{2}G^{2}c^{-10}}$
$\sqrt{h^{-2}K^{2}G^{-2}c^{4}}$	$\sqrt{h^{-1}K^{2}G^{-1}c^{1}}$	$\sqrt{h^{0}K^{2}G^{0}c^{-2}}$ electric impedance electric resistance	$\sqrt{h^{1}K^{2}G^{1}c^{-5}}$ electrical resistivity	$\sqrt{h^{2}K^{2}G^{2}c^{-8}}$
$\sqrt{h^{-2}K^{2}G^{-2}c^{6}}$	$\sqrt{h^{-1}K^{2}G^{-1}c^{3}}$ elastance	$\sqrt{h^{0}K^{2}G^{0}c^{0}}$ coulomb constant	$\sqrt{h^{1}K^{2}G^{1}c^{-3}}$	$\sqrt{h^{2}K^{2}G^{2}c^{-6}}$

And again it is more elucidating if in stead of K we use constant K/c as a ratio:

$$K/c = \frac{\text{electro magnetic flux}}{\text{electric charge}}, \frac{\text{electromagnetic vector potential}}{\text{electric vector potential}}, \frac{\text{electric scalar potential}}{\text{electric current}}, \frac{\text{electric fieldstrength}}{\text{magnetic fieldstrength}}.$$

Electric permittivity ϵ_0 as a ratio:

$$\epsilon_0 = \frac{\text{electric vector potential}}{\text{electric scalar potential}}, \frac{\text{dieëlectric displacement}}{\text{electric fieldstrength}}.$$

Magnetic permeability μ_0 as a ratio:

$$\mu_0 = \frac{\text{electromagnetic vector potential}}{\text{electric current}}, \frac{\text{magnetic induction}}{\text{magnetic fieldstrength}}.$$

Because velocity is a vector quantity, the speed of light is also a vector. And because burst is a vector quantity and mass is a scalar quantity we see that G is also a vector and G/c is a scalar. Likewise Coulomb constant K is a vector and K/c is a scalar.

We have to realise what it means that c, G and K are constants. It means that they are relativistic. Once if you understand what relativity really is, you see an other pattern in the quantity tables: hypercomplex numbers. In my first essay I found the general metric, describing a manifold composed of 16 dimensions. In this model special relativity and general relativity are fused into one system. The General metric:

$$df_r^2 + dl_x^2c^2 + dl_y^2c^2 + dl_z^2c^2 + G^2\frac{dE_r^2}{c^6} + G^2ds_x^2 + G^2ds_y^2 + G^2ds_z^2 =$$
$$dt_r^2c^4 + \frac{db_x^2}{c^2} + \frac{db_y^2}{c^2} + \frac{db_z^2}{c^2} + G^2\frac{dm_r^2}{c^2} + G^2\frac{dp_x^2}{c^4} + G^2\frac{dp_y^2}{c^4} + G^2\frac{dp_z^2}{c^4}$$

Octonions of the General metric, or the "Chain of Symbols" (imaginary units $\mathbf{i}$, $\mathbf{j}$, $\mathbf{k}$ and $\mathbf{L}$):

$$o_f = f_r + \mathbf{i}l_x c + \mathbf{j}l_y c + \mathbf{k}l_z c + \mathbf{L}\frac{G}{c^3}E_r + \mathbf{iL}Gs_x + \mathbf{jL}Gs_y + \mathbf{kL}Gs_z$$
$$o_t = -t_r c^2 - \mathbf{i}\frac{b_x}{c} - \mathbf{j}\frac{b_y}{c} - \mathbf{k}\frac{b_z}{c} - \mathbf{L}\frac{G}{c}m_r - \mathbf{iL}\frac{G}{c^2}p_x - \mathbf{jL}\frac{G}{c^2}p_y - \mathbf{kL}\frac{G}{c^2}p_z$$

If we take a look at the Maxwell equations we can also derive a metric. The electromagnetic metric, a continuum composed of 2 dimensions. Described by complex numbers.

B. The octonionic model of gravity changes some of the well known equations

The modified energy-mass relation:

$$E = m(ic)^2 \tag{1}$$
$$E = -mc^2 \tag{2}$$

The escape velocity, $v_e = \sqrt{\frac{2GM}{r}}$, originaly derived by John Michel is not a relativistic factor therefore the modified Schwarzschild metric:

$$ds^2 = c^2\left(1 - \frac{G^2M^2}{r^2c^4}\right)dt^2 - \frac{1}{\left(1 - \frac{G^2M^2}{r^2c^4}\right)}dr^2 - r^2 d\omega.$$

C. The dimension of the ratio of the gravitational constant and the electrostatic force constant

Above we found the ratio's for G and K.

$$G/K = \frac{\text{gmflux}}{\text{mass}} \cdot \frac{\text{electric charge}}{\text{magnetic-flux}}$$
$$\sqrt{G/K} = \sqrt{\frac{\text{gmflux}}{\text{mass}} \cdot \frac{\text{elecric charge}}{\text{magnetic flux}}}$$

On the other hand we have the relation:

$$F = G\frac{m^2}{r^2} \text{ and } F = K\frac{Q^2}{r^2}$$

$$G\frac{m^2}{r^2} = K\frac{Q^2}{r^2}$$
$$\sqrt{G/K} = \frac{\text{electric charge}}{\text{mass}}.$$
$$\sqrt{G/K} = \frac{\text{gravitomagnetic flux}}{\text{electromagnetic flux}}.$$

Therefore we get the important dimensional equalities:

$$\frac{\text{electric charge}}{\text{mass}} = \frac{\text{gravitomagnetic flux}}{\text{electromagnetic flux}}.$$
$$\text{electric charge} \cdot \text{electromagnetic flux} = \text{mass} \cdot \text{gravitomagnetic flux}.$$

D. The planck equations extended

In the list below the first two are the well known planck equations. From the quantity tables we see that we can formulate three more equations:

$$
\begin{aligned}
h =& \text{energy} \cdot \frac{\text{time}}{\phi} \\
h =& \text{momentum} \cdot \frac{\text{length}}{\phi} \\
h =& \text{mass} \cdot \frac{\text{gm-flux}}{\phi} \\
h =& \text{string} \cdot \frac{\text{burst}}{\phi} \\
h =& \text{instant} \cdot \frac{\text{valention}}{\phi}
\end{aligned}
$$

E. The dimension of the fine structure constant

After we analyzed the dimensions of c, G, K and h we finally can analyze the *fine structure constant.*

$$\alpha = \frac{\mathrm{e}^2}{\hbar c 4\pi\epsilon_0} = \frac{\mathrm{e}^2 K}{\hbar c}$$

Or written with h. (em-burst is the cell below (electro)magnetic flux):

$$a = \frac{\mathrm{e}^2 K}{hc} = \frac{\text{e-charge}^2 \, \frac{\text{em-burst}}{\text{e-charge}}}{\text{mass} \cdot \frac{\text{gmflux}}{\phi} \, \frac{\text{em-burst}}{\text{em-flux}}}$$

$$= \frac{\text{e-charge} \cdot \text{em-flux}}{\text{mass} \cdot \frac{\text{gmflux}}{\phi}}$$

In subsection C we saw that the product of *electric charge* and *electromagnetic flux* has the same dimension as the product of *mass* and *gravitomagnetic flux.* Energy, momentum, time and length are quantities of the gravitomagnetic system. Planck's constant is the product of those quantities divided by the phase. I will write the original planck constant as h_g. We don't have any justification that this planck constant is also part of the planck unit of the electro- and electromagnetic quantities. I conject that the fine structure constant a is the ratio between two different planck constants. I suggest that there is another planck constant that has a different value then the original planck constant:

$$a = \frac{\mathrm{h}_e}{\mathrm{h}_g}$$

The new conjected planck constant:

$$\mathrm{h}_e = \text{e-charge} \cdot \frac{\text{em-flux}}{\phi}$$

Now we can write out the planck units of electric charge and magnetic flux:

$$
\begin{aligned}
\text{e-charge} =& \sqrt{\mathrm{h}_e 4\pi\epsilon \ \mathrm{c}} \\
\text{em-flux} =& \sqrt{\mathrm{h}_e (4\pi\epsilon)^{-1} \mathrm{c}^{-1}}
\end{aligned}
$$

Possibly this results in a new Heisenberg uncertainty relation like:

$$1/2\hbar_e\phi = \Delta\text{e-charge} \cdot \Delta\text{em-flux}.$$

I suggest that all planck units of the main sequences of the electro and electromagnetic quantities, the planck unit will be exchanged by the electromagnetic planck unit h_e the columns to the right have then to be divided by gm-length which has planck unit $\sqrt{h_g G c^{-2}}$.

F. The planck units

The ratio of the quantities gmflux and burst determines the speed of light. The ratio of the quantities burst and mass determines the gravitational constant. The product of $\frac{\text{gm-flux}}{\phi}$ and mass determines the planck constant. To normalize lightspeed to one we must adjust the unit of burst to the unit of gmflux. To normalize the gravitational constant we must adjust the unit of mass to the unit of burst. But we are still free to choose one unit arbitrary. But if we want to normalize the planck constant to one then we have to choose an absolute unit. So this absolute unit is tied up in nature. But this is only the case when we take phase into account. Phase is inherently connected with the planck constant. The product gm-flux · mass doesn't give the planck constant, only $\frac{\text{gm-flux}}{\phi} \cdot$ mass gives the planck constant. It's like a sphere. We can wrap as many area as we want around the sphere, but only when we take into account the phase, we determine the surface of the sphere. There is no smallest area but there exists a smallest sphere. It is just like the measurement paradox in quantummechanics. A measurement is like taking away the phase out from the physical system at a particular event (wavefunction collapse). The confusion arises when we make no difference between length ('position') and wavelength. Phase is the only *non-local* quantity and is responsible for quantum entanglement. The other quantities are *local* quantities because they are connected with each other by relativity. The planck unit of gm-flux written out in dimensions:

$$\sqrt{h \cdot \frac{G}{c}} = \sqrt{\frac{\text{gm-flux}}{\phi} \cdot \text{mass} \cdot \frac{\frac{\text{burst}}{\text{mass}}}{\frac{\text{burst}}{\text{gm-flux}}}}$$

All symmetries like rotational, translational and Lorenz symmetry are consistent with a continuous universe. There is no reason for discretion of both particles and spacetime. Also the planck units do not suggest that spacetime itself is discrete. If the planck unit is the root of the product of compton-wavelength and schwarzschild length, then we have to take care of the phase in the planck unit: $\sqrt{\frac{1}{\phi}}$. But what does this root means? I don't know.

G. Quadratic structure of the Maxwell equations

$$\begin{aligned}
\epsilon\nabla \cdot \mathrm{E} &= 0 \\
\mu\nabla \cdot \mathrm{H} &= 0 \\
-\nabla \times \mathrm{E} &= \mu\frac{\delta H}{\delta t} \\
\nabla \times \mathrm{H} &= \epsilon\frac{\delta \mathrm{E}}{\delta \mathrm{t}}
\end{aligned}$$

Quaternion product:

$$\begin{aligned}
\nabla\mathrm{E} &= \nabla \cdot \mathrm{E} + \nabla \times \mathrm{E} \\
\nabla\mathrm{H} &= \nabla \cdot \mathrm{H} + \nabla \times \mathrm{H}
\end{aligned}$$

$$\begin{aligned}
-\nabla\mathrm{E} &= \mu\frac{\delta H}{\delta t} \\
\nabla\mathrm{H} &= \epsilon\frac{\delta \mathrm{E}}{\delta \mathrm{t}}
\end{aligned}$$

$$-\frac{\mathrm{E}}{\mu\mathrm{H}} = \frac{\mathrm{H}}{\epsilon\mathrm{E}}$$
$$-\epsilon\mathrm{E}^2 = \mu\mathrm{H}^2$$
$$\epsilon\mathrm{E}^2 + \mu\mathrm{H}^2 = 0$$

If we look at the quantity tables, this last equation is the same as the following equation with magnetic flux ϕ_m and electric charge q.

$$\mu\phi_{m-}^2 + \epsilon\mathrm{q}_-^2 = 0$$

Maxwell equations are the same for both positive charge and negative charge:

$$\mu\phi_{m-}^2 + \epsilon\mathrm{q}_-^2 = \mu\phi_{m+}^2 + \epsilon\mathrm{q}_+^2$$

This last metric can be decomposed into two complex numbers (the roots of μ and ϵ not shown):

$$\mathrm{C}_1 = \mathrm{q}_{e+} + i\phi_{m+}$$
$$\mathrm{C}_2 = -\mathrm{q}_{e-} - i\phi_{m-}$$

This electromagnetic scalar metric is interesting if we compare this with the gravitomagnetic scalar metric. The scalar metric of the gravitomagnetic system is part of the general metric.

$$\text{emflux}_+^2 + \text{electric charge}_+^2 = \text{emflux}_-^2 + \text{electric charge}_-^2$$
$$\text{gmflux}^2 + \text{energy}^2 = \text{time}^2 + \text{mass}^2$$

In electromagnetism two objects with opposite charge like positive and negative charge attract each other. Two objects with the same charge repel each other. In gravitomagnetism two objects with opposite charges like mass and energy attract each other. But also two objects with the same charge attract each other. There is a difference between the gravitomagnetic scalar metric and the electromagnetic scalar metric. Mass and energy have different planck units. But positive electric charge and negative electric charge have the same planck unit. The case that the gravitomagnetic scalar metric is part of the octonionic model and that the electromagnetic scalar metric is part of the complex number model. This must be somehow the reason for their different behaviour.

H. Relativistic quantities

Non-relativistic quantities: t, l, f, b, s, m, p, E; Relativistic quantities: $-tc^2$, ilc,f, $-i\frac{b}{c}$, $iL\frac{G}{C}sc$, $-L\frac{G}{C}m$, $-iL\frac{G}{C}\frac{p}{c}$, $L\frac{G}{C}\frac{E}{c^2}$. The physical equations have their origin in and are limited by the relativistic quantities. The last three tables of this essay contain relativistic quantities. Different quantities have different physical manifestations. Different quantities can not have the same physical manifestation. Different physical manifestations can represent the same quantity. For example quantity energy can be represented by different physical manifestations. Mass and energy are different quantities. In addition Einstein said that “Mass and energy are different physical manifestations of the same thing”. That is not the same as ’mass and energy are the same thing’. They are not. Einstein related radioactive decay of uranium salts and the equivalence between mass and energy. Nuclear fission of U-235 is an exothermic reaction which can release large amounts of energy. Mass is exchanged for energy. So the total mass will reduce while the total energy increases.

In both **non-relativistic mechanics** and in **relativistic mechanics** we can set the numerical value of the speed of light to one c = 1 and also we can set the numerical value of the gravitational constant to one G = 1. In relativity time and length can be measured by the same unit due to the invariance of the speed of light. More generally time, length, energy, momentum and mass and other alike quantities can also be measured by the same unit due to the invariance of both the speed of light and the gravitational constant. But that these different quantities of the gravitomagnetic system can be measured by the same unit is not the same as saying that they are the same quantities.

Equations must be dimensional correct. An expression in which for example mass and velocity are equivalent is wrong. Therefore personaly I am not fond of leaving away the symbols of quantities in equations. Different quantities can have the same dimension. In **non-relativistic mechanics** mass and energy have different dimension. Quantities represent dimensions. Some quantities like the fine structure constant are dimensionless. In **relativistic mechanics** we must be carefull when we say that mass and energy have the same dimension. In relativistic mechanics we can

leave away the symbol of the speed of light. $E = -mc^2$ turns into $E = -m$. This becomes clear if we realise that we can see mass, momentum and energy as having the same dimension. In the same way we can see length and time as having the same dimension. Relativistic velocity is the ratio of relativistic length and relativistic time and therefore becomes dimensionless. But there are still dimensional differences between quantities that have the same dimension. Quantities with the same dimension can differ in units and signatures of the complex number: (1, i, -1, -i). The quantities differ in their unit and signature. The (1, i, -1, -i) units and signatures are the new dimensional units and signatures and the relativistic equations must be 'new dimensional' correct.

We can leave away the symbols c and G but we can't leave away the (imaginary) units and signatures, otherway the equations are not dimensional correct. So if we use relativistic quantities then we take complex numbers into account. In **special relativity** if we leave away the speed of light c, by making the numerical value c = 1. And leave away the symbol of the speed of light. What remains is the complex structure. In **general relativity** we can leave away both G and c. Set the numercial value to one G = 1. And leave away the symbols of the speed of light and the gravitational constant. Again what remains is the (hyper)complex structure. If we do this then we understand that special relativity and general relativity are the same. *Dual quantities* are different quantities and have different manifestations, but their dimensions have the same signature. For example energy and instant E = I or time and valention t = val. *Opposite quantities* are different quantities and have different manifestations, their dimensions have opposite signature. For example energy and mass are opposite quantities. E = -m. or time and gmflux t = -f.

I. Conclusion

We found a complex number structure underlying the Maxwell equations. So the Maxwell equations consists of two parts. The quaternionic part is due to gravitomagnetic octonionic metric. The complex number part is due to the electromagnetic scalar metric. Spacetime with a fibre bundle.

The planck unit as a specific limit is a very vague concept. The question is if it is such a specific limit as is suggested. What about upper and lower planck limits? Gravitomagnetic flux has a lower limit and mass has an upper limit. If electromagnetic charge exists then it has the same planck unit as electromagnetic flux. But has electromagnetic flux a lowerlimit and electric charge an upperlimit?

Also the realisation that the planck constant is a totally gravitomagnetic quantity isn't generally realized. The fine structure constant suggests that there are at least two different planck constant's: a gravitomagnetic planck constant and an electromagnetic planck constant.

classical relativistic mechanics: nothing can go faster then light. Quantum mechanics: spooky action at a distance, 'faster then light'. Relativity is divided into spacelike and timelike events. In quantum mechanics we speak of local and non-local happenings. My first thought was that the difference is the phase. In relativity the speed of light is composed of quantities (thus local). But quantum effects, the collapsing of the wavefunction, says that the effect is a non-local effect, even biljon lightyears away. Possibly phase is responsible. Phase has no connection with relativity. But how could the phase know to which wave it is/was connected. In relativity there is the space-time continuum. Different observers cut differend slices of this spacetime. The point is that the events lay already down in spacetime. The same accounts for the wavefunctions in quantum mechanics. The only sensible explanation for those non-local spooky connections is that the wavepatterns are already frozen in this spacetime continuum. Wavepatterns are rigid frozen patterns in spacetime. So there is no spooky action at a distance. Our thinking is the problem. We think in developing wavefunctions and we think that we can influence them. But we must think in a way in which the wavepatterns are already there. Also our experiments as if we can influence them, already lay down as patterns in spacetime. How did this al come into existence? We already think in processes developing in time. Most of our physical laws are based on developing in time, even waves. But the problem of wavefunction collapse is best explained by wavepatterns already frozen in spacetime. It is the only logical explanation for this spooky action at a distance. Our measurements are also already frozen in time. We can't influence any wavefunction in any way.

There is a difference between quantities and physical objects. Spacetime, particles and waves are all physical objects. Spacetime is continuous and particles are discrete. But the media that is undulating is continuous. A reason for discrete are standing waves. And there are also resonances. There is no reason for that spacetime is discrete. Physical objects are mostly composed of different quantities.

If we have waves, then the medium of the wave is by itself continuous. A standing wave can have a discrete number, but it's not logical to project that onto time and length. The discretenous and not-distcritoues depends on the phase. just like circumference or wavelength versus length. Quantum mechanics is nothing more then classical relativistic mechanics extended with the phase.

Introducing phase into our quantities then we automatically jump from classical relativistic mechanics to relativistic quantum mechanics. We can also see that quantity 'force' still remains even in relativistic quantum mechanics where forces are described by bosons.

FIG. 8: Relativistic mass table

y^1 $\left(\frac{G}{Lc}\right)^2 (ic)^2$ lenape	$L\,y^1$ $\left(\frac{G}{Lc}\right)^1 (ic)^2$ instant	$-y^1$ $\left(\frac{G}{Lc}\right)^0 (ic)^2$ time	$-L\,y^1$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^2$ san	y^1 $\left(\frac{G}{Lc}\right)^{-2} (ic)^2$ marser
$-i\,y^1$ $\left(\frac{G}{Lc}\right)^2 (ic)^1$ sjan	$i\,L\,y^1$ $\left(\frac{G}{Lc}\right)^1 (ic)^1$ string	$i\,y^1$ $\left(\frac{G}{Lc}\right)^0 (ic)^1$ length	$-i\,L\,y^1$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^1$ lao	$-i\,y^1$ $\left(\frac{G}{Lc}\right)^{-2} (ic)^1$ tai
$-y^1$ $\left(\frac{G}{Lc}\right)^2 (ic)^0$ chono	$-L\,y^1$ $\left(\frac{G}{Lc}\right)^1 (ic)^0$ mass	y^1 $\left(\frac{G}{Lc}\right)^0 (ic)^0$ gmflux	$L\,y^1$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^0$ jangil	$-y^1$ $\left(\frac{G}{Lc}\right)^{-2} (ic)^0$ nuenonne
$i\,y^1$ $\left(\frac{G}{Lc}\right)^2 (ic)^{-1}$ jamana	$-i\,L\,y^1$ $\left(\frac{G}{Lc}\right)^1 (ic)^{-1}$ momentum	$-i\,y^1$ $\left(\frac{G}{Lc}\right)^0 (ic)^{-1}$ burst	$i\,L\,y^1$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^{-1}$ jarawa	$i\,y^1$ $\left(\frac{G}{Lc}\right)^{-2} (ic)^{-1}$ yug
y^1 $\left(\frac{G}{Lc}\right)^2 (ic)^{-2}$ selknam	$L\,y^1$ $\left(\frac{G}{Lc}\right)^1 (ic)^{-2}$ energy	$-y^1$ $\left(\frac{G}{Lc}\right)^0 (ic)^{-2}$ valention	$-L\,y^1$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^{-2}$ onge	y^1 $\left(\frac{G}{Lc}\right)^{-2} (ic)^{-2}$ khoi

FIG. 9: Relativistic velocity table

$-i\,y^0$ $\left(\frac{G}{Lc}\right)^2 (ic)^1$ $\frac{\text{sjan}}{\text{flux}}$	$i\,L\,y^0$ $\left(\frac{G}{Lc}\right)^1 (ic)^1$ gravitational permittivity	$i\,y^0$ $\left(\frac{G}{Lc}\right)^0 (ic)^1$ $\frac{\text{length}}{\text{flux}}$	$-i\,L\,y^0$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^1$ gravito-magn. permeability	$-i\,y^0$ $\left(\frac{G}{Lc}\right)^{-2} (ic)^1$ $\frac{\text{tai}}{\text{flux}}$
$-y^0$ $\left(\frac{G}{Lc}\right)^2 (ic)^0$ $\frac{\text{chono}}{\text{flux}}$	$-L\,y^0$ $\left(\frac{G}{Lc}\right)^1 (ic)^0$ $\frac{\text{mass}}{\text{flux}}$	y^0 $\left(\frac{G}{Lc}\right)^0 (ic)^0$ $\frac{\text{flux}}{\text{flux}}$	$L\,y^0$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^0$ $\frac{\text{jangil}}{\text{flux}}$	$-y^0$ $\left(\frac{G}{Lc}\right)^{-2} (ic)^0$ $\frac{\text{nuenon}}{\text{flux}}$
$i\,y^0$ $\left(\frac{G}{Lc}\right)^2 (ic)^{-1}$ $\frac{\text{jamana}}{\text{flux}}$	$-i\,L\,y^0$ $\left(\frac{G}{Lc}\right)^1 (ic)^{-1}$ $\frac{\text{momentum}}{\text{flux}}$	$-i\,y^0$ $\left(\frac{G}{Lc}\right)^0 (ic)^{-1}$ velocity	$i\,L\,y^0$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^{-1}$ gravicity	$i\,y^0$ $\left(\frac{G}{Lc}\right)^{-2} (ic)^{-1}$ $\frac{\text{yug}}{\text{flux}}$
y^0 $\left(\frac{G}{Lc}\right)^2 (ic)^{-2}$ $\frac{\text{selknam}}{\text{flux}}$	$L\,y^0$ $\left(\frac{G}{Lc}\right)^1 (ic)^{-2}$ potential	$-y^0$ $\left(\frac{G}{Lc}\right)^0 (ic)^{-2}$ $\frac{\text{valention}}{\text{flux}}$	$-L\,y^0$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^{-2}$ $\frac{\text{onge}}{\text{flux}}$	y^0 $\left(\frac{G}{Lc}\right)^{-2} (ic)^{-2}$ $\frac{\text{khoi}}{\text{flux}}$
$-i\,y^0$ $\left(\frac{G}{Lc}\right)^2 (ic)^{-3}$ quantity[illegible]	$i\,L\,y^0$ $\left(\frac{G}{Lc}\right)^1 (ic)^{-3}$ force	$i\,y^0$ $\left(\frac{G}{Lc}\right)^0 (ic)^{-3}$ quantity[illegible]	$-i\,L\,y^0$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^{-3}$ quantity$_{\alpha}$	$-i\,y^0$ $\left(\frac{G}{Lc}\right)^{-2} (ic)^{-3}$ quantity[illegible]

FIG. 10: Relativistic action table

y^2 $\left(\frac{G}{Lc}\right)^2 (ic)^2$ lenape·flux	$L\,y^2$ $\left(\frac{G}{Lc}\right)^1 (ic)^2$ north	$-y^2$ $\left(\frac{G}{Lc}\right)^0 (ic)^2$ area	$-L\,y^2$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^2$ san·flux
$i\,y^2$ $\left(\frac{G}{Lc}\right)^2 (ic)^1$ sjan·flux	$-i\,L\,y^2$ $\left(\frac{G}{Lc}\right)^1 (ic)^1$ mass-centre motion	$-i\,y^2$ $\left(\frac{G}{Lc}\right)^0 (ic)^1$ autumn	$i\,L\,y^2$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^1$ lao·flux
$-y^2$ $\left(\frac{G}{Lc}\right)^2 (ic)^0$ mass^2	$-L\,y^2$ $\left(\frac{G}{Lc}\right)^1 (ic)^0$ action	y^2 $\left(\frac{G}{Lc}\right)^0 (ic)^0$ flux·flux	$L\,y^2$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^0$ jangil·flux
$-i\,y^2$ $\left(\frac{G}{Lc}\right)^2 (ic)^{-1}$ jamana·flux	$i\,L\,y^2$ $\left(\frac{G}{Lc}\right)^1 (ic)^{-1}$ east	$i\,y^2$ $\left(\frac{G}{Lc}\right)^0 (ic)^{-1}$ spring	$-i\,L\,y^2$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^{-1}$ jarawa·flux
y^2 $\left(\frac{G}{Lc}\right)^2 (ic)^{-2}$ selknam·flux	$L\,y^2$ $\left(\frac{G}{Lc}\right)^1 (ic)^{-2}$ energy·flux	$-y^2$ $\left(\frac{G}{Lc}\right)^0 (ic)^{-2}$ valention·flux	$-L\,y^2$ $\left(\frac{G}{Lc}\right)^{-1} (ic)^{-2}$ onge·flux