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Invariance through the universality of the number *'1'*

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Abstract:

This paper briefly outlines eight examples of invariance, all grounded in the unit *'1'* as the fundamental form of invariance. Two of these are well known, while six are original contributions derived from the author's earlier works.

Introduction:

Invariance denotes the property of a system or a law of nature to remain unchanged under certain transformations (e.g., temporal, spatial, or symmetric).

The number *'1'* is the universal normative form of invariance, as it represents the measure of immutability and the neutral element in many formalisms (e.g., the identity matrix, normalized probability, natural units).

The two best-known invariances are:

1. **Special relativity – the speed of light**
   Lorentz factor:

$$\gamma = \sqrt{1/(1 - v^2/c^2)} \tag{1}$$

→ For a body at rest, $v = 0$, $\gamma = 1$, which is an invariant value.

2. **Thermodynamics – Boltzmann distribution**

$$\sum p_i = 1 \quad , \quad p_i = e^{-E_i/kT} / Z \tag{2}$$

→ Invariant value: the sum of probabilities = 1, regardless of temperature or energy levels.

Although not every invariance results in the value *'1'*, in this work attention is directed to those that do, in order to provide a clearer view of structural connections. The derived formulas originate from my earlier works published on this portal; therefore, their meaning is not elaborated here, but rather adapted with the aim of emphasizing precisely this invariance.

3. Uncertainty principle

The most significant invariance in this work is presented here in the form (3) and also in the calculation given in the table.

$$3*e^{2\pi}/4+3*\log_2(2\pi)+1/(\mu\alpha+2)-\log_2\gamma*(1+\alpha^{-2}*\log_2\mu)= 1 \qquad \textbf{\textit{(3)}}$$

where ***e*** is the base of the natural logarithm, and three fundamental physical constants (***α*** – the fine-structure constant, ***μ*** – the proton-to-electron mass ratio, ***γ*** – the neutron-to-proton mass ratio) yield the invariant value ***'1'***. The slight inaccuracy in the result (1.00000000173) is a consequence of numerical instability in the computation due to handling extremely small and widely differing orders of magnitude of the constants.

α = 0.0072973525693	μ = 1836.15267343	γ = 1.00137841920
$q = \log_2\gamma*(1+\alpha^{-2}\log_2\mu)$		404.628455364
$3*e^{2\pi}/4 + 3*\log_2(2\pi)/2 + 1/(2\mu\alpha+4) - q =$		1.00000000173

Thus, the combination of constants leads to the invariant value ***'1'***, which is interpreted as an expression of the uncertainty principle.

4. Lepton mass relationship – corrected Koide formula

In the corrected Koide formula, Bošković's *non-cohesive* limits [1] for leptons ***(r_{mu}, r)***, together with the fundamental limit of nature ***f*** and the mathematical constants ***π*** and ***2/3***, yield the invariant value ***'1'***, here transformed into expression:

$$\pi f*\left[\left(\xi\alpha+r_{mu}^2+r_\tau^2\right)/\left(\alpha^{0.5}+r_{mu}+r_\tau\right)^2-2/3\right]=1 \qquad \textbf{\textit{(4)}}$$

and the *non-cohesion* limits (radii) are reduced with the radius of the fundamental particle and based on the masses for the muon and the tau:

$m_{mu} = 1.883531627*10^{-28}$ kg, $m_\tau = 3.1674852349178*10^{-27}$ kg

$r_f = 3.231309*10^{-15}$ m

So the resulting values are dimensionless (all given in the table):

α =	0.0072973525693	**μ** =	1836.15267343
$\xi = 2\pi*2^{(4/3-1/(1.5*\mu\alpha+3))}/(\mu\alpha) =$	1.14669171435	***f = 2q/3***	*269.7523035762*
r_{mu} =	1.3153700912	r_τ =	5.3940976434
$\pi*f*[(\xi\alpha+r_{mu}^2+r_\tau^2)/(\alpha^{0.5}+r_{mu}+r_\tau)^2-2/3] =$			1.0000000000

where ***q*** was calculated in the previous invariance.

→ Invariant value: ***'1'***, expressed through the *non-cohesive limits* of the second– and third–generation leptons, is not directly tied to the same limit of the electron, but rather to a quantity associated with it – the fundamental particle and the constants ***π, 2/3***, ***μ*** and ***α***, as markers of the leptonic transition from the first to the second and third generation.

5. Gravitational invariance:

I propose that the formula for gravitational acceleration (including the contribution of the "rest of the universe") can be expressed as a sum:

$$g = g_s + g_n \qquad \textbf{\textit{(5)}}$$

By dividing, we obtain:

$$g / g_s - g_n / g_s = 1 \qquad \textbf{\textit{(5b)}}$$

where:

- g_s – gravitational acceleration of the remainder of the universe (6.9581783*10^-10 m/s^2),
- g_n – Newtonian part of gravity, opposite in direction to the former,
- g – the resultant (actual) acceleration.

→ Invariant value: ***'1'***.

For celestial bodies, the contribution of g_s in formula ***(5)*** plays only a minor role, but for this work formula ***(5b)*** is crucial. It shows that in a natural system where g_s = 1, whenever we use Newton's gravitational acceleration g_n instead of g, we would make an error of exactly the invariant value ***'1'***!

6. Emergence of mass from the preceding mass:

The quantum process of emergence the mass x_n from the preceding mass of an elementary particle x_{n-1} takes place with the preservation of invariance:

$$x_n / x_{n-1} - x_{n-1}^{-1.5} = 1 \qquad \textbf{\textit{(6)}}$$

The newly created mass x_n fully originates from the previous mass x_{n-1} through quantum action, while maintaining the invariant value ***'1'***. All values are reduced with respect to the mass of the fundamental limit:

$$m_f = 1.08862171145 \cdot 10^{-28}\ kg = 61.06719949\ MeV/c^2.$$

This formula connects bare and constituent particles (example shown in the table).

	Bare (x_0)	constituent masses	
particle	$x_0 = [m/m_f]$ [MeV/c²]	$x_n = x_{n-1} + x_{n-1}^{-0.5}$ I	II
bottom	**68.54368** **4185.77**	**68.664** **4193.15**	**68.785** **4200.52**
fundamental	**1.000000** **61.06719949**	**2.000** **122**	**2.707** **165**
down	**0.07691539** ***4.70***	**3.683** ***224.89***	**4.204** ***256.71***

The results are presented in parallel in two systems:

1. **Unit system** – reduced to the mass of the fundamental particle, so that the formula holds;
2. **MeV/c²** – the standard unit in particle physics.

To highlight the difference in mass growth, two quarks were deliberately chosen: one “light” (down) and one “heavy” (bottom).

7. Transition to extensive – Neutron/proton magnetic moment ratio:

The following formula, obtained heuristically by relying on Boscovich's theory and the fundamental particle, represents the establishment of volumetric structure as a transition from Boscovich's non-extensive and massless to the material and spatial.

This represents a way to arrive at the spatial-material structure, with the participation of mathematical constants ***2*** and π and physical constants μ, α and g_{pn} – the ratio of the magnetic moments of the proton and neutron (see table).

$$g_{pn} = -\sqrt{\frac{2*\mu}{(1+4\pi*\alpha^{-1})}} * \left(1+\frac{\alpha^2}{\sqrt{(2\pi)^3}}\right) \qquad \textbf{\textit{(7)}}$$

- Factor: $\sqrt{1/(1+4\pi*\alpha^{-1})}$

  Shows structural similarity with the Lorentz factor from ***(1)***.

- Factor: $1+\alpha^2/\sqrt{(2\pi)^3}$

  also contains the invariant ***’1’***.

Values	**2018**
α	0.0072973525693
μ	1836.15267343
g_{pn} = formula (7)	**-1.45989806**

8. Anomalous Magnetic Dipole Moments of Leptons:

The relationship between anomalous magnetic moments of leptons ***(a_e, a_m, a_τ)*** involvesh three ratios containing the invariant ***'–1'***, which together yield a fourth invariant ***'1'***.

$$\frac{1}{b*a_e-1}+\frac{2}{b*a_m-1}+\frac{2}{b*a_\tau-1}=1 \qquad (8)$$

The values that enable this formula are given in the table:

α =	***b = 2π/α***	
0.0072973525693	861.02257599735	
a_e^{exp}	***a_m^{ideal}***	***a_τ^{ideal}***
0.00115965218128	0.001165920898844	0.00117722126026
$1/(b*a_e - 1) + 2/(b*a_{mu} - 1) + 2/(b*a_\tau - 1) = 1$		
1.0000000000001		

So, the second and third generations of leptons exhibit a double influence compared to the first.

The superscript „ideal“ indicates that the values are adjusted to satisfy formula ***(8)*** and another formula that, together with this one, forms an ontological whole of the anomalous lepton moments, though it is not part of this work.

It is proposed that invariance be applied in a broader context to allow for targeted investigation.

References:

[1] Boscovich, R.: 1758, *Philosophiae naturalis theoria redacta ad unicam legem virium in natura existentium*, Beč (prvo izdanje; 1763, Venecija, (drugo izdanje); 1922 i 1966, A Theory of natural philosophy, Open Court, London i The Massachusetts Institute of Technology, M.I.T. Press, Cambridge (redom); 1974, *Teorija prirodne filozofije svedena na jedan jedini zakon sila koje postoje u prirodi*, (dvojezično: latinski i hrvatski), Liber, Zagreb..