# Relationships are fundamental

**Email:** ***bzivlak@gmail.com***

**Abstract**: Nothing exists for itself, everything is connected. Relationships are important in all sciences, both natural and social. Here we will focus on the most common interest of the participants in this competition, and these are the relations that are important for the functioning of the universe. The attitudes here are mostly expressed in math, which is due to the same comprehension for everyone due to translation problems, especially when it is a Google translate (as here).

## Introduction

To quote from Wikipedia [1]:

**Relationship** most often refers to:

- Interpersonal relationship, a strong, deep, or close association or acquaintance between two or more people
- Correlation and dependence, relationships in mathematics and statistics between two variables or sets of data

or from British Dictionary [2]:

Definitions for relationship

- **Relationship** /rɪˈleɪʃənʃɪp/ noun
- 1. the state of being connected or related
- 2. association by blood or marriage; kinship
- 3. the mutual dealings, connections, or feelings that exist between two parties, countries, people, etc. a business relationship

Relationships are ubiquitous, also in mathematics and in physics. All the great discoveries of physics, from Newton, Kepler, Maxwell, Planck, and others, are expressed in relatively simple mathematical relations. Physical theories that do not contain such relations survive on the basis of the prestige of their supporters and the search for new explanations, new constants, new dimensions and new forces. Such theories will go into oblivion if they find no relationships that will confirm them.

It will be here about immanent relations of the whole and parts of the universe. The relations that will be shown would not have been possible if there were no discoveries of Max Planck, and everything is given in the Planck units.

One special case of relationship are the opposites, which deserve much more attentive in natural sciences than it is the case so far. Interesting is the text in [3] from where we quote:

*-Notice that all spatial and directional dimensions are opposites: up vs. down, inside vs. outside, high vs. low, long vs. short, North vs. South, big vs. small, here vs. there, top vs. bottom, left vs. right. And notice that all things we consider serious and important are one pole of a pair of opposites: good vs. evil, life vs. death, pleasure vs. pain, God vs. Satan, freedom vs. bondage.*

*So also, our social and esthetic values are always put in terms of opposites: success vs. failure, beautiful vs. ugly, strong vs. weak, intelligent vs. stupid. Even our highest abstractions rest on opposites. Logic, for instance, is concerned with the true vs. the false; epistemology, with appearance vs. reality; ontology, with being vs. non-being.*

***Our world seems to be a massive collection of opposites.***

A good feature of the opposites is that they are easy to be noticed in the plenty of information. So we will better recognize love and hatred than all the other manifestations of the feelings that exist between them. It is the same in physics, as can be seen in [4].

The most common wish of the FQX's contestants is to explain the functioning of the universe. Therefore, we will give here two more important definitions in order to know what we are discussing. Under the term universe we mean:

***Universe is all that exist***

Thus the term as the "parallel universe" has become inappropriate because it would follow that there is more of everything that exists. Let us apply then the term independent part of the universe.

For me, the term

***Singularity is "undefined" [5].***

*-In mathematics, a* ***singularity*** *is in general a point at which a given mathematical object is not defined, or a point of an exceptional set where it fails to be well-behaved in some particular way, such as differentiability.*

The use of this mathematical term in physics in the sense that contradicts the above definition for me is inadmissible, introduces confusion and leads physics into a dead end. Given that physicists use math to a large extent, they should without exception, accept the above definition.

# Relationships

Planck's values in physics are often extremes that are in opposition to some other extreme or are the geometric mean of two opposites, for example: The hypothetical quantum mass ($2.723388288 * 10^{-69}$ kg) and the mass of the universe ($1.73944912 * 10^{53}$ kg) have a Planck mass for the geometric mean.

Also:

***-The Planck length is believed to be the shortest meaningful length, the limiting distance below which the very notions of space and length cease to exist*** **[6].**

Another reason that we will show relationships in Plank's units is to simplify formulas. So we calculate with dimensionless values because, for example, we express the mass of the protons as $7.68488*10^{-20}$ of the Planck mass.

Here the results are based on two dimensional constants and Planck mass and length, while Planck time is indirectly expressed over the speed of light, because $\mathbf{c = l_{pl} / t_{pl}}$. The reason for this is that it is usual for the speed of light to be exactly defined in all systems of measures.

**Dimensionless constants**

| | |
|---|---|
| **inverse alpha $\alpha^{-1}$=** | **137,0359990734** |
| **proton-electron mass ratio μ=** | **1836,15267245** |
| **speed of light in Planck units c=** | **1** |

It is to be expected that the universal constants and Planck values are also equal to "1", when expressed in Planck's units, as can be seen in Table 1.

**Table 1. Values in Planck units**

| | | | meaning |
|---|---|---|---|
| **speed of light** | **$c=l_{pl}/t_{pl}$** | **299792458** | **upper limit** |
| Universal gravitational constant | $G=c^2l_{pl}/m_{pl}$ | 6,67384E-11 | |
| Reduced Planck constant | **$\hbar=cm_{pl}l_{pl}$** | **1,05457E-34** | |
| **Planck …** | **formula** | **value** | |
| **length** | **$l_{pl}=\sqrt{(\hbar G/c^3)}$** | **1,61620E-35** | **lower limit** |
| **Time** | **$t_{pl}=\sqrt{(\hbar G/c^5)}$** | **5,39106E-44** | **lower limit** |
| **mass** | **$m_{pl}=(\hbar c/G)^{0.5}$** | **2,17651E-08** | **Geom. mean** |
| **Momentum** | **$M_{pl}=\hbar/l_{pl}=(\hbar c^3/G)^{0.5}$** | **6,525012538** | **Geom. mean** |
| **Energy** | **$E_{pl}=m_{pl}c^2=(\hbar c^5/G)^{0.5}$** | **1956149547** | **Geom. mean** |
| **Force** | **$F_{pl}=c^4/G$** | **1,21034E+44** | **upper limit** |
| **acceleration** | **$a_{pl}=c/t_{pl}=\sqrt{(c^7/\hbar G)}$** | **5,56092E+51** | **upper limit** |
| **Power** | **$S_{pl}=c^5/G$** | **3,62851E+52** | **upper limit** |
| **Pressure** | **$P_{pl}=F_{pl}/A_{pl}=c^7/\hbar G^2$** | **4,6336E+113** | **upper limit** |
| **Density** | **$\rho_{pl}=c^5/\hbar G^2=1/Gt_{pl}^2$** | **5,15557E+96** | **upper limit** |
| **Temperature** | **$T_{pl}=(\hbar c^5/Gk_B^2)^{0.5}$** | **1,41683E+32** | **upper limit** |

In Table 2 are some important mass and radii organized by decreasing value. The values of level n in column two can also be determined using the Planck mass relation to the observed mass (underlined formula in the header) and by the ratio of the radius to the Planck length (formula with italic in the header). This column is not necessary because we know the formulas in the first column, but it facilitates the detection of significant opposites and relationships between constants. Note that the empty fields in the radius and mass can be calculated by formulas in the header and also have a theoretical significance. There will be no mention of them here and they are omitted. The process of obtaining the values of the level q and levels of the protons and neutrons has been extensively explained in [7]. For this work it is less important whether these formulas are correct (and they are), because the aim is to show that the relations always exists regardless of whether we know it or not.

**Table 2 Fundamental relations between some physical constants in Planck units**

| Relations | $n=q/2+\log_2(m_{pl}/m)$<br>$n=q-2*\log_2(r/l_{pl})$ | radius<br>$r=l_{pl}2^{q/2-n/2}$ | mass<br>$m=m_{pl}2^{q/2-n}$ |
|---|---|---|---|
| **Planck mass** | | | |
| $m_{pl}$ | 202,3142277 | | 1 |
| **Inverse Rydberg constant** | | | |
| $r_\infty=1/R_\infty=4\pi*\alpha^{-2}\hbar/m_{el}c$ | *220,2537997* | 5,63834E+27 | |
| **Bohr radius** | | | |
| $a_0=\alpha^{-2}r_{er}$ | *241,7536142* | 3,27421E+24 | |
| **Neutron mass** | | | |
| $e^{2\pi}/2-2+1/(\mu*\alpha^{-1}+2)-q/(1+\alpha^{-2}\log_2\mu)$ | 265,8087795 | | 7,69547E-20 |
| **Proton mass** | | | |
| $e^{2\pi}/2-2+1/(\mu*\alpha^{-1}+2)=$ | 265,8107668 | | 7,68488E-20 |
| **Classical electron radius** | | | |
| $r_{er}=\hbar*\alpha^{-1}/m_{el}c$ | *270,1472587* | 1,74356E+20 | |
| **Electron mass** | | | |
| $m_{el}=m_p/\mu$ | 276,6532371 | | 4,18532E-23 |
| **Planck length** | | | |
| $q=[3e^{2\pi}/2+3\log_2(2\pi)+1/(\mu*\alpha^{-1}+2)]/2-1$ | 404,6284554 | 1 | |

For Planck's mass, n = q / 2 is obtained, which is the arithmetic mean between 0 (zero) and q. The Planck mass is the geometric mean mass between the mass at the level n = 0 (mass of the universe) and the mass at the level n = q. Likewise, at the plane of the Plank mass, a radius can be determined, which is the geometric mean of the radius of the universe at the level of zero and Plank's length at the level of q. Thus, Planck's length is in opposition to the whole of the radius of the universe.

Also, opposites are the mass and radiation, because it is valid that the product of mass and corresponding Compton wavelengths is constant:

$$m*h/mc=h/c \qquad (1)$$

***So, "matter dominant universe" and "radiation dominant Universe" coexist in every point in time.***

*There is no room for weird understanding of their change during the history of the Universe* [8].

Writing in the form of Table 2 allows you to see many other relationships. Thus, for the CMB temperature in the developed form, a relation (2) is obtained, which can be easily verified in the Planck units but also in any other system of measurements:

$$T_{BG}=(2\pi)^{-1/4}*c^2*m_{pl}*k_B^{-1}*\sqrt{3*2^{-q/2}*q^{-1}} \qquad (2)$$

Where, $k_B$ is Boltzmann constant. To get the relationship between temperatures, the use of the opposites also greatly helps, see more in [9] and [4].

Interestingly, three key relationships related to fine structure constant are:

$$\alpha^{-1} = l_{pl} * m_{pl} * r_{er}^{-1} * m_{el}^{-1} \qquad (3)$$

$$\alpha^{-2} = \left[ q / \log_2 (m_{ne} * m_p^{-1}) - 1 \right] / \log_2 (m_p * m_{el}^{-1}) \qquad (4)$$

$$\alpha^{-3} = r_{\infty} * (4\pi * r_{er})^{-1} \qquad (5)$$

Where is: $r_{er}$ - classical electron radius, $r_{\infty}$ - Inverse of Rydberg constant, $m_{el}$ - electron mass, $m_{ne}$ - neutron mass, $m_p$ - proton mass

I assume that the first linear alpha is in the function of electrons. Second, surface alpha is in the function of a nucleus, and the third spatial alpha is responsible for the existence of matter and space.

This further leads to the conclusion: Three dimensions of space emerge as a consequence of the relationships in the universe, and is not its essence. Adding new dimensions does not have a foothold in the essence of the relationship in the universe. It is only an expression of powerlessness due to a lack of understanding of relations in the observed phenomena.

## Do physical laws and physical constants change?

Each planet and star have its final lifetime, but Kepler's laws describing relations between them are eternal. The same applies to Newton's, Maxwell's and Planck's laws ... and the phenomena to which they relate.

All physical constants in Table 1 will always have a value of “1” and also an unchanging value in any system of measurements. Obviously, all the constants that arise from mathematical constants are immutable. In my previous FQX-essay [10, formula 17] I also showed it for some physical constants.

The least known is the status of the fine structure constant. Here I will give two possible hypotheses:

**1.** The fine structure constant is fixed in time and is the same in every part of the universe. The problem is, that it is necessary to determine many other so far unknown relationships to understand this constant.
**2.** Alpha is constant in each independent part of the universe, but is changing from one independent part of the universe to another. This then means that the mass of the electron and the Rydberg constant, and therefore the atoms and chemical elements are quite different in each of the independent parts of the universe.

Much more likely I consider the first hypothesis.

# Conclusion

The predictive power of Table 2. Is shown. The displayed results can be easily checked in any system of measurements by replacing the values for the speed of light, the Planck mass and the length. Also, it is shown:

***The fundamental relationships are, not spatial dimensions that emerge.***

***Plank units are either extreme or geometric mean among the opposing values.***

As such, they have always existed and will exist. For example, the fact that changes within the entire mass of the universe are continually occurring does not affect the Planck mass, which will always be the geometric mean. The same applies to the CMB temperature which is not any relic of the beginning of the universe but the geometric mean of all temperatures.

I also agree with the following understanding, which I quote:

*-Starting from the philosophical comprehensions that (1) the total sum of all the attractions and the sum of all repulsions in the universe remains constant and that (2) each individual attraction is compensated by corresponding repulsions, and vice versa, the results of modern sciences have shown that (3) an attraction at any level of the structure of matter is compensated by the repulsions at a higher and a lower levels (Empedocles' rule).* [11]

So, let's add:

***Attraction and repulsion are the most important opposites that governs movements in nature.***

Table 2 provides an insight into the relationships in nature and the overall coherence of the phenomenon.

# References:


[1] https://en.wikipedia.org/wiki/Relationship edited on 16 December 2017, at 15:42

[2] http://www.dictionary.com/browse/relationship

[3] https://theunboundedspirit.com/unity-in-the-world-of-opposites/

[4] Zivlak B, Opposites in Physics**,** http://gsjournal.net/Science-Journals/Essays/View/6423

[5] https://en.wikipedia.org/wiki/Singularity_(mathematics), edited on 14 December 2017, at 14:47.

[6] https://en.wikipedia.org/wiki/Planck_length, edited on 17 December 2017, at 06:46

[7] Zivlak B, Cycle towards Methodology of Everything, http://gsjournal.net/Science-Journals/Research%20Papers-Unification%20Theories/Download/6731

[8] Zivlak B, The Theory of Unity between the Whole and its Parts, https://fqxi.org/data/essay-contest-files/Zivlak_Theory2017.pdf

[9] Zivlak B, Hypotetical Quantum of Temperature, http://www.researchgate.net/profile/Branko_Zivlak/publications

[10] Zivlak B, Mathematical Connection Among the Structures of Universe, http://fqxi.org/data/essay-contest-files/Zivlak_MathStructure.pdf

[11] Dragoslav Stoiljković, https://www.researchgate.net/publication/300230119_ATTRACTION_AND_REPULSION_AS_THE_ESSENCE_OF_MATTER_-_FROM_ANCIENT_PHILOSOPHY_TO_CONTEMPORARY_SCIENCE