Negatio et negatio negationis

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Abstract

Objective: The relationship between the philosophical notion negation and the physical notion Lorentz factor is investigated.

Methods: The axiom lex identitatis was used to explore whether there is any relationship between the philosophical notion negation and physics as such.

Results: Starting with lex identitatis it was possible to provide evidence that 0/0=1. Furthermore, a general form of negation was determined.

Conclusions: Overwhelming evidence suggests that the philosophical notion negation and the physical notion Lorentz factor are more or less identical.

Keywords: ***Negatio, negatio negationis, physics.***

1. Introduction

The concepts of identity, difference, negation, opposition et cetera engaged the attention of scholars at least over the last twenty-three centuries (Horn, 1989). As long as we first and foremost follow *Josiah Royce*, **negatio** or negation "is one of the simplest and most fundamental relations known to the human mind. For the study of logic, no more important and fruitful relation is known." (Royce, 1917, p. 265). *Aristotle*'s was one of the first to present a theory of negation, which can be found in discontinuous chunks in his works the *Metaphysics*, the *Categories*, *De Interpretatione*, and the *Prior Analytics* (Horn, 1989, p. 1). **Negation** (Newstadt, 2015) as a fundamental philosophical concept found its own melting point especially in Hegel's dialectic and is more than *just a formal logical process or operation* which converts only true to false and false to true. Negation as such is a natural process too and equally "an engine of changes of objective reality" (I. Barukčić, 2019a). However, it remains an open question to establish a generally accepted link between this fundamental philosophical concept and an adequate counterpart in physics, mathematics and mathematical statistics et cetera. Especially the relationship between *creatio ex nihilio* (Donnelly, 1970; Ehrhardt, 1950; Ford, 1983), *determination and negation (Ayer, 1952; Hedwig, 1980; Heinemann, 1943; Kunen, 1987)* has been discussed in science since ancient (Horn, 1989) times too. The development of the notion negation leads from **Aristotle** to **Meister Eckhart** von Hochheim, commonly known as Meister Eckhart (Tsopurashvili, 2012; von Hochheim (1260–1328), 1986) or Eckehart, to **Spinoza** (1632 – 1677), to Immanuel **Kant** (1724-1804) and finally to Georg Wilhelm Friedrich **Hegel** (1770-1831) and other. One point is worth being noted, even if it does not come as a surprise, is was especially Benedict de Spinoza (1632 – 1677) as one of the philosophical founding fathers of *the Age of Enlightenment* who addressed the relationship between determination and negation in his lost letter of June 2, 1674 to his friend Jarig Jelles (Förster & Melamed, 2012) by the discovery of his fundamental insight that "***determinatio negatio est***" (Spinoza, 1802, p. 634). Hegel went even so far as to extended the slogan raised by Spinoza's to "***Omnis determinatio est negatio***" (Hegel, 1812). Finally, negation entered the world of mathematics and mathematical logic at least with **Boole** (Boole, 1854) publication in the year 1854. "*Let us, for simplicity of conception, give to the symbol x the particular interpretation of men, then 1 - x will represent the class of 'not-men'.*" (Boole, 1854, p. 49). The notion negation found his way to physics by the contribution of authors like Woldemar **Voigt** (Voigt (1850-1919), 1887), George Francis **FitzGerald** (FitzGerald (1851-1901), 1889), Hendrik Antoon **Lorentz** (Lorentz (1853-1928), 1892), Joseph **Larmor** (Larmor (1857-1942), 1897), Jules Henri **Poincaré** (Poincaré (1854-1912), 1905) and Albert **Einstein** (1879-1955) (A. Einstein, 1905b) on the notion "*Lorentz factor*".

2. Methods and material

Some authors define an indeterminate form as an expression which involves two functions whose limit cannot be determined solely while other prefer another approach. Especially the division 0/0 or 1/0 is a more and more pressing problem in science.

2.1. Methods

2.1.1. Definitions

Definition 1. (The number + 1)

Let c denote *the speed of light in vacuum* (Drude, 1894; Tombe, 2015; W. E. Weber & Kohlrausch, 1856; W. Weber & Kohlrausch, 1857), let ε_0 denote the electric constant and let μ_0 the magnetic constant. Let *i* denote the imaginary number (Bombelli, 1579). The number +1 is defined as the expression

$$+(c^2 \times \varepsilon_0 \times \mu_0) \equiv +1 + 0 \equiv -i^2 = +1 \tag{1}$$

while "=" denotes the equals sign (Recorde, 1557) or equality sign (Rolle, 1690) used to indicate equality and "-" (Pacioli, 1494; Widmann, 1489) denotes minus signs used to represent the operations of subtraction and the notions of negative as well and "+" denotes the plus (Recorde, 1557) signs used to represent the operations of addition and the notions of positive as well.

Definition 2. (The number + 0)

Let c denote the speed of light in vacuum (Drude, 1894; Tombe, 2015; W. E. Weber & Kohlrausch, 1856; W. Weber & Kohlrausch, 1857), let ε_0 denote the electric constant and let μ_0 the magnetic constant. Let *i* denote the imaginary number (Bombelli, 1579). The number +0 is defined as the expression

$$+(c^2 \times \varepsilon_0 \times \mu_0) - (c^2 \times \varepsilon_0 \times \mu_0) \equiv +1 - 1 \equiv -i^2 + i^2 = +0 \tag{2}$$

while "=" denotes the equals sign (Recorde, 1557) or equality sign (Rolle, 1690) used to indicate equality and "-" (Pacioli, 1494; Widmann, 1489) denotes minus signs used to represent the operations of subtraction and the notions of negative as well and "+" denotes the plus (Recorde, 1557) signs used to represent the operations of addition and the notions of positive as well.

Remark 1.

The definition of the basic numbers +1 and +0 in terms of physical "constants" provides the possibility to test **classical logic or mathematical theorems** et cetera by reproduceable physical experiments. In particular, it is very remarkable that Leibniz (Leibniz, 1703) himself published in 1703 the first self-consistent binary number system representing all numeric values while using typically 0 (zero) and 1 (one).

Definition 3. (The sample space)

Let ${}_{R}C_{t}$ denote the set of all the possible outcomes of a random experiment, a phenomenon in nature, at a (random) Bernoulli trial t. Let ${}_{0}x_{t}$ denote an event, a subset of the sample space ${}_{R}C_{t}$. Let ${}_{0}x_{t}$ denote the negation of an event ${}_{0}\underline{x}_{t}$, another, complementary subset of the sample space ${}_{R}C_{t}$. In general, we define the sample space ${}_{R}C_{t}$ as

$$ {}_{R}C_{t} \equiv \{ {}_{0}x_{t} \quad , \quad {}_{0}\underline{x}_{t} \} \tag{3} $$

or equally as

$$ {}_{R}C_{t} \equiv {}_{0}x_{t} + {}_{0}\underline{x}_{t} \tag{4} $$

In other words, and according to quantum theory, the sample space ${}_{R}C_{t}$ at one certain Bernoulli trial t is in a state of superposition of ${}_{0}x_{t}$ and ${}_{0}\underline{x}_{t}$. Under conditions of classical logic, it is $({}_{0}x_{t} + {}_{0}\underline{x}_{t}) = {}_{R}C_{t} = +1$.

Definition 4. (The Eigen-Value of ${}_{0}x_{t}$)

Under conditions of classical logic, ${}_{0}x_{t}$ can take only one of the values

$$ {}_{0}x_{t} \equiv \{+0 \quad , \quad +1\} \tag{5} $$

Definition 5. (The Eigen-Value of ${}_{0}\underline{x}_{t}$)

Under conditions of classical logic, ${}_{0}\underline{x}_{t}$ can take only one of the values

$$ {}_{0}\underline{x}_{t} \equiv \{+0 \quad , \quad +1\} \tag{6} $$

Definition 6. (The general form of negation)

Let ${}_{0}\underline{x}_{t}$ denote the negation of an event/outcome/eigenvalue ${}_{0}x_{t}$ (i. e. anti ${}_{0}x_{t}$). In general, we define the simple mathematical form of negation ${}_{0}\underline{x}_{t}$ of an event/outcome/eigenvalue ${}_{0}x_{t}$ as

$$ {}_{0}\underline{x}_{t} \equiv {}_{R}C_{t} - {}_{0}x_{t} \tag{7}$$

Under conditions of classical logic 'anti ${}_{0}x_{t}$' passes over to 'not ${}_{0}x_{t}$'. Negation is a very important concept in philosophy (Newstadt, 2015) and classical logic. In classical logic, negation converts false to true and true to false. In other words, it is

$$ {}_{0}\underline{x}_{t} \equiv \left(\sim {}_{0}x_{t}\right) \times \left({}_{R}C_{t} = 1\right) \tag{8}$$

where ˜ denotes the sign of negation of classical logic. So, if ${}_{0}x_{t}$= +1 (or true), then (˜ ${}_{0}x_{t}$)×1= ${}_{0}\underline{x}_{t}$ (pronounced 'not ${}_{0}x_{t}$' or equally 'anti ${}_{0}x_{t}$') would therefore be ${}_{0}\underline{x}_{t}$ = +0 (false); and conversely, if ${}_{0}\underline{x}_{t}$ = +1 (true) then (˜ ${}_{0}\underline{x}_{t}$)×1= ${}_{0}x_{t}$ = +0 would be false.

Table 1. The relationship between ${}_{0}x_{t}$ and ${}_{0}\underline{x}_{t}$

Bernoulli trial t	${}_{0}x_{t} = (\tilde{}\,{}_{0}\underline{x}_{t})\times 1$	${}_{0}\underline{x}_{t} = (\tilde{}\,{}_{0}x_{t})\times 1$	${}_{0}\underline{x}_{t} + {}_{0}\underline{x}_{t} = {}_{R}C_{t}=1$	${}_{R}C_{t}$
1	+1	+0	+1 +0 = +1	+1
2	+1	+0	+1 +0 = +1	+1
3	+0	+1	+0 + 1 = +1	+1
4	+0	+1	+0 +1 = +1	+1
…	…	…	…	…

The first and very simple mathematical or algebraical formulation of *the notion negation* was published by Georg Boole. In general, following Boole, negation in terms of algebra, can be expressed something as ${}_{0}\underline{x}_{t}$ =1-${}_{0}x_{t}$. According to Boole, "*… in general, whatever … is represented by the symbol x, the contrary … will be expressed by 1 - x*" (Boole, 1854, p. 48). In other words, according to Boole, "*If x represent any … objects, then … 1 - x represent the contrary or supplementary …*" (Boole, 1854, p. 48). Under conditions of classical logic, it is ${}_{R}C_{t}$ = 1, and Boole's most simple form of negation can be abbreviated as "**1-**" too. **The *double negation*** would be (**1-**(**1-** ${}_{0}x_{t}$)) = ${}_{0}x_{t}$ and is sometimes identical with negatio negationis or **the negation of negation**. In a slightly different way, it is necessary to generalize Boole's simple form of negation to a general form of Boole's negation as

$$ {}_{0}\underline{x}_{t} \equiv {}_{R}C_{t} - {}_{0}x_{t} \tag{9}$$

Equally, it is in the same respect that

$$ {}_{0}x_{t} \equiv {}_{R}C_{t} - {}_{0}\underline{x}_{t} \tag{10} $$

Normalizing, we obtain (I. Barukčić, 2019b) ***the general normalized form of negation*** as

$$ {}_{0}x_{t} \equiv \left(\mathbf{1} - \left(\frac{{}_{0}\underline{x}_{t}}{{}_{R}C_{t}}\right)\right) \times {}_{R}C_{t} \tag{11} $$

Under conditions of classical logic, it is $\mathbf{{}_{R}C_{t} = +1}$ and we obtain

$$ {}_{0}x_{t} \equiv \left(1 - \left(\frac{{}_{0}\underline{x}_{t}}{+1}\right)\right) \times +1 \tag{12} $$

or

$$ {}_{0}x_{t} \equiv \left(1 - \left({}_{0}\underline{x}_{t} \right)\right) \times +1 \tag{13} $$

and extremely simplified

$$ {}_{0}x_{t} \equiv \left(\sim\left({}_{0}\underline{x}_{t} \right)\right) \times 1 \tag{14} $$

Definition 7. (The right-angled triangle)

A right-angled triangle is a triangle in which one angle is 90-degree angle. Let ${}_{R}C_{t}$ denote the *hypotenuse*, the side opposite the right angle (side ${}_{R}C_{t}$ in the figure 1). The sides a_t and b_t are called legs. In a right-angled triangle ABC, the side AC, which is abbreviated as b_t, is the side which is *adjacent* to the angle α, while the side CB, denoted as a_t, is the side *opposite* to angle α. The following figure 1 ((Bettinger & Englund, 1960), p. 117) may illustrate a right-angled triangle.

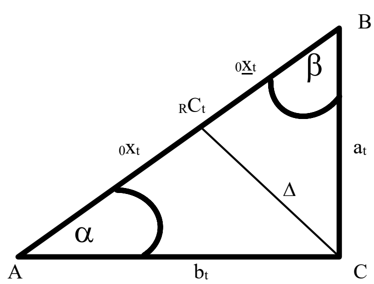

Figure 1. A right-angled triangle

Definition 8. (The relationship between ${}_0x_t$ and anti ${}_0\underline{x}_t$)

In general, we define

$$\left({}_0x_t \right) + \left({}_0\underline{x}_t \right) \equiv {}_RC_t \tag{15}$$

and

$$a_t^2 \equiv {}_0x_t \times {}_RC_t \tag{16}$$

and

$$b_t^2 \equiv {}_0\underline{x}_t \times {}_RC_t^2 \tag{17}$$

Remark 2.

The equation ${}_RC_t = {}_0x_t + {}_0\underline{x}_t$ is valid even under conditions of classical (bivalent) logic. Under conditions of classical bivalent logic, it is ${}_RC_t = +1$ while ${}_0x_t$ takes the only values *either* +0 *or* +1. Since ${}_0\underline{x}_t = {}_RC_t - {}_0x_t$, ${}_0\underline{x}_t$ itself takes also only the values *either* +0 *or* +1. However, if ${}_0x_t$ = 0 then ${}_0\underline{x}_t$ = 1and vice versa. If ${}_0x_t$ = 1 then ${}_0\underline{x}_t$ = 0.

Definition 9. (Euclid's theorem)

Euclid's (ca. 360 - 280 BC) derived his geometric mean theorem or *right triangle altitude theorem* or Euclid's theorem and published the same in his book Elements (Euclid & Taylor, 1893) in a corollary to proposition 8 in Book VI, used in proposition 14 of Book II to square a rectangle too, as

$$\Delta_t^2 \equiv \frac{(a_t^2) \times (b_t^2)}{{}_RC_t^2} = {}_RC_t^2 \times \left(\sin^2(\alpha) \times \cos^2(\alpha)\right) = \left({}_0x_t \right) \times \left({}_0\underline{x}_t \right) \tag{18}$$

Definition 10. (Pythagorean theorem)

The Pythagorean theorem is defined as

$$\left({}_RC_t \times \left(\left({}_0x_t \right) + \left({}_0\underline{x}_t \right) \right) \right) = \left({}_RC_t \times {}_0x_t \right) + \left({}_RC_t \times {}_0\underline{x}_t \right) = (a_t^2 + b_t^2) \equiv {}_RC_t^2 \tag{19}$$

Definition 11. (The normalization of the Pythagorean theorem)

The *normalization* (I. Barukčić, 2013, 2016) of the Pythagorean theorem is defined as

$$\left(\frac{a_t^2}{{}_RC_t^2}\right)+\left(\frac{b_t^2}{{}_RC_t^2}\right) = \sin^2(\alpha)+cos^2(\alpha) \equiv +1 \tag{20}$$

Definition 12. (The variance of the Pythagorean theorem)

The variance σ^2 of a right-angled triangle (I. Barukčić, 2013, 2016) is defined as

$$\sigma_t^2 \equiv \frac{(a_t^2)\times(b_t^2)}{({}_RC_t^2)\times({}_RC_t^2)} \equiv \sin^2(\alpha)\times\sin^2(\beta) = \sin^2(\alpha)\times\cos^2(\alpha) = \frac{\Delta_t^2}{({}_RC_t^2)} \tag{21}$$

Definition 13. (The Lorentz factor)

The **Lorentz factor** (A. Einstein, 1905b; FitzGerald (1851-1901), 1889; Larmor (1857-1942), 1897; Lorentz (1853-1928), 1892; Poincaré (1854-1912), 1905; Voigt (1850-1919), 1887) **squared** or Lorentz term squared denoted as γ^2 is defined as

$$\gamma^2 = \frac{+1}{\left(1-\left(\frac{\mathrm{v}^2}{c^2}\right)\right)} \tag{22}$$

where v is the relative velocity between inertial reference frames and c is the speed of light (Rømer (1644–1710) & Huygens (1629-1695), 1888) in a vacuum. In general, it is

$$\left(1-\left(\frac{\mathrm{v}^2}{c^2}\right)\right) \times \gamma^2 = +1 \tag{23}$$

Definition 14. (Einstein's special theory of relativity)

Einstein discovered the equivalence (A. Einstein, 1905b) of mass and energy. "Gibt ein Körper die Energie L in From von Strahlung ab, so verkleinert sich seine Masse um L/V^2" (A. Einstein, 1905a). Under conditions of Einstein's special theory of relativity, it is

$$m_0 = \sqrt[2]{1-\frac{v^2}{c^2}} \times m_R \tag{24}$$

were m_0 denotes the "rest-mass" as measured by the co-moving observer at a certain (period or point in) time t, m_R denotes the "relativistic-mass" as measured by the stationary observer at a same or simultaneous (period or point in) time t, *v* is the relative velocity between the co-moving and the stationary observer, c is the speed of the light in vacuum. Einstein's mass–energy equivalence (A. Einstein, 1935) can be normalized (I. Barukčić, 2013, 2016) as

$$\frac{m_0^2}{m_R^2} + \frac{v^2}{c^2} = +1 \tag{25}$$

Multiplying the equation above by the speed of the light in vacuum c squared, we obtain

$$\begin{aligned} \underbrace{m_0 \times c^2} &= \sqrt[2]{1-\frac{v^2}{c^2}} \times \underbrace{m_R \times c^2} \\ E_0 &= \sqrt[2]{1-\frac{v^2}{c^2}} \times E_R \\ E_0^2 &= \left(1-\frac{v^2}{c^2}\right) \times E_R^2 \end{aligned} \tag{26}$$

were $E_0 = m_0 \times c \times c$ denotes the rest-energy (A. Einstein, 1935) as measured by i. e. by a co-moving observer Bob (B), an observer at rest in the moving system, moving with constant velocity v relatively to the stationary system were Alice (A) is located. Let $E_R = m_R \times c \times c$ denote ***the total relativistic energy*** (Lewis & Tolman, 1909; Tolman, 1912) of the same entity as measured by in the stationary system by Alice (A) at the same (period of) time. Furthermore, let $\underline{E}_0 = E_R - E_0$ denote the local hidden variable.

Definition 15. (Modus inversus)

Let ${}_{R}P_{t}$ denote *a premise* from the standpoint of a stationary observer R, a Bernoulli distributed random variable at a certain period of time or *Bernoulli trial* (Uspensky, 1937, p. 45) *t*. The premise can take only the values ${}_{R}P_{t} = \{+0; +1\}$. Let ${}_{R}C_{t}$ denote *a conclusion* from the standpoint of a stationary observer R, a Bernoulli distributed random variable at the same period of time or Bernoulli trial *t*. The conclusion ${}_{R}C_{t}$ can take only the values ${}_{R}C_{t} = \{+0; +1\}$. Under conditions of classical logic, +0 may denote *false* while +1 may denote *true*. The **modus inversus** is defined as *if* (premise is false) *then* (conclusion is false). The following table (**Table 1**) may illustrate *modus inversus* (I. Barukčić, 2019c, pp. 181–182) in more detail.

Table 1. Modus inversus

		Conclusion ${}_{R}C_{t}$		
		+0=false	+1=true	
Premise ${}_{R}P_{t}$	**+0=false**	+1	+0	
	+1=true	+1	+1	
				1

Formally, modus inversus can be expressed too as

$$ {}_{R}P_{t} \cup \neg {}_{R}C_{t} = 1 \tag{27} $$

where ∪ denotes disjunction or inclusive or. As can be seen, it is not possible to achieve a true conclusion while starting with a false premise.

2.1.2. Axioms

Whether science needs new and obviously generally valid statements (axioms) which are able to assure the truth of theorems proved from them may remain an unanswered question. In order to be accepted, a new axiom candidate (Easwaran, 2008) should be at least as simple as possible and logically consistent to enable advances in our knowledge of nature. "**Die wahrhaft großen Fortschritte der Naturerkenntnis sind auf einem der Induktion fast diametral entgegengesetzten Wege entstanden.**" (Albert Einstein, 1919, p. 17). In general, Einstein himself advocated basic law (axioms) and conclusions derived from the same as a logical foundation of any 'theory'. "**Grundgesetz (Axiome) und Folgerungen zusammen bilden das**

was man eine 'Theorie' nennt." (Albert Einstein, 1919, p. 17). *Lex identitatis* i.e. "**Chaque chose est ce qu'elle est. Et dans autant d'exemples qu'on voudra A est A, B est B**" (Hessen, 1928; Korch, 1965), *lex contradictionis* (Boole, 1854; Hessen, 1928; Korch, 1965) and *lex negationis* (Hegel, 1812; Hegel, Di Giovanni, & Hegel, 2010; Newstadt, 2015) have the potential to denote the most simple, the most general and the most far reaching axioms of science, the foundation of our today's and of our future scientific inquiry.

Axiom 1. (Lex identitatis)

$$+1 \equiv +1 \tag{28}$$

Axiom 2. (Lex contradictionis)

$$+0 \equiv +1 \tag{29}$$

3. Results

THEOREM 3.1 (LEX EXCLUSII TERTII (THE LAW OF THE EXCLUDED MIDDLE))

CLAIM.

The simple form of the law of the excluded middle follows as

$$+1+0 = +1 \tag{30}$$

PROOF.

In general, starting with lex identitatis, it is

$$+(\mathbf{1}) = +(\mathbf{1}) \tag{31}$$

Adding +1-1, we obtain

$$+1+1-1 = +1+1-1 \tag{32}$$

Since +1-1 = 0, it is

$$+1+0 = +1 \tag{33}$$

QUOD ERAT DEMONSTRANDUM.

THEOREM 3.2 (THE LAW OF DOUBLE NEGATION)

Lex identitatis is appropriate enough to derive proof-theoretically the double negation.

CLAIM.

The simple form of the law of double negation follows as

$$\sim\sim\left(+\ {}_{0}x_{t}\ \right) = \left(+\ {}_{0}x_{t}\ \right) \tag{34}$$

PROOF.

In general, starting with lex identitatis, it is

$$+(\mathbf{1}) = +(\mathbf{1}) \tag{35}$$

or

$$(+1) \times\ {}_{0}x_{t} = (+1) \times\ {}_{0}x_{t} \tag{36}$$

or

$${}_{0}x_{t} = {}_{0}x_{t} \tag{37}$$

Adding -1, it is

$$+\ {}_{0}x_{t}\ - 1 = +\ {}_{0}x_{t}\ - 1 \tag{38}$$

or

$$+1 - 1 +\ {}_{0}x_{t} = +\ {}_{0}x_{t} \tag{39}$$

Today's rule's of mathematics demand that

$$+1 - \left(1 -\ {}_{0}x_{t}\ \right) = +\ {}_{0}x_{t} \tag{40}$$

or that

$$\sim\sim\left(+\ {}_{0}x_{t}\ \right) = \left(+\ {}_{0}x_{t}\ \right) \tag{41}$$

QUOD ERAT DEMONSTRANDUM.

THEOREM 3.3 (+0/+0 = +1)

CLAIM.

According to Einstein's special theory of relativity, it is

$$\frac{+0}{+0} = +1 \tag{42}$$

PROOF.

In general, taking axiom 1 to be true, it is

$$+1 \equiv +1 \tag{43}$$

Multiplying by m_0, the "rest-mass" as measured by the co-moving observer at a certain (period or point in) time t, it is

$$m_0 = m_0 \tag{44}$$

or according to Einstein's special theory of relativity,

$$m_0 = \sqrt[2]{1 - \frac{v^2}{c^2}} \times m_R \tag{45}$$

were m_R denotes the "relativistic-mass" as measured by the stationary observer at a same or simultaneous (period or point in) time t, v is the relative velocity between the co-moving observe B and the stationary observer A, c is the speed of the light in vacuum. Simplifying it is

$$m_0^2 = \left(1 - \frac{v^2}{c^2}\right) \times m_R^2 \tag{46}$$

or

$$\frac{m_0^2}{m_R^2} = \left(1 - \frac{v^2}{c^2}\right) \tag{47}$$

The normalized relativistic energy-momentum relation (I. Barukčić, 2013, 2016) follows as

$$\frac{m_0^2}{m_R^2} + \frac{v^2}{c^2} = +1 \tag{48}$$

Under conditions, where **$v > 0$**, m_0 does not equal to m_R as can be viewed by the equation before. Simplifying, we obtain

$$\frac{v^2}{c^2} = 1 - \frac{m_0^2}{m_R^2} \tag{49}$$

In general, it is

$$v^2 = c^2 \times \left(1 - \frac{m_0^2}{m_R^2}\right) \tag{50}$$

Under conditions of the theory of special relativity where the relative velocity is **$v > 0$**, we divide the equation before by the term **$c^2\times(1-((m_0^2)/(m_R^2)))$**, which itself is different from zero, and we obtain

$$\frac{v^2}{(c^2) \times \left(1 - \frac{m_0^2}{m_R^2}\right)} = +1^2 \tag{51}$$

Under conditions of the theory of special relativity where **$v > 0$**, any reference frame moving with uniform motion will observe this law of nature with the consequence that this equation under conditions of the theory of special relativity is generally valid and can be tested by real-world experiments. However, Newtonian mechanics is a limiting case of Einstein's special relativity theory, especially under conditions where **$v = 0$**. "*The existence of the Newtonian limit of special relativity theory shows ... the former as a limiting case of the latter ... when objects move with velocities v that are small compared with the value of c in empty space*" (Rivadulla, 2004). Under conditions where the relative velocity $v = 0$, Einstein's theory of special relativity pass over into Newtonian mechanics. Under these conditions it is

$$\frac{m_0^2}{m_R^2} + \frac{0^2}{c^2} = +1^2 \tag{52}$$

or equally $(m_0^2) = (m_R^2)$, and we obtain

$$\frac{0^2}{(c^2) \times \left(1 - \frac{m_0^2}{m_0^2}\right)} = +1^2 \tag{53}$$

In general, under conditions of Einstein's theory of special relativity where the relative velocity **$v = 0$**, it is equally **$v^2 = (1-((m_0^2)/(m_R^2)))\times c^2 = 0^2$**, as can be seen before. We obtain

$$\frac{0^2}{0^2} = \frac{0 \times 0}{0 \times 0} = \frac{+0}{+0} = +1 \tag{54}$$

QUOD ERAT DEMONSTRANDUM.

THEOREM 3.4 (NEGATION AND LORENTZ FACTOR SQUARED ARE IDENTICAL)

CLAIM.

The general from of negation and Lorentz factor squared are identical as

$$\left(1 - \left(\frac{\mathrm{v}^2}{c^2}\right)\right) = \left(1 - \left(\frac{{}_{0}\underline{x}_t}{{}_{R}C_t}\right)\right) \tag{55}$$

PROOF.

In general, taking axiom 1 to be true, it is

$$+1 \equiv +1 \tag{56}$$

Multiplying by ${}_{R}C_t$ we obtain $1 \times {}_{R}C_t = 1 \times {}_{R}C_t$ or

$${}_{R}C_t \equiv {}_{R}C_t \tag{57}$$

Subtracting ${}_{0}\underline{x}_t$, we obtain

$${}_{R}C_t - {}_{0}\underline{x}_t \equiv {}_{R}C_t - {}_{0}\underline{x}_t \tag{58}$$

Rearranging equation it is

$${}_{R}C_t - {}_{0}\underline{x}_t + {}_{0}\underline{x}_t \equiv {}_{R}C_t \tag{59}$$

In particular, due to our definition ${}_{0}x_t = {}_{R}C_t - {}_{0}\underline{x}_t$, the equation changes to

$$+ {}_{0}x_t + {}_{0}\underline{x}_t \equiv {}_{R}C_t \tag{60}$$

Normalizing the relationship (under conditions where the operation is allowed), it is

$$+\frac{{}_{0}x_t}{{}_{R}C_t} + \frac{{}_{0}\underline{x}_t}{{}_{R}C_t} \equiv \frac{{}_{R}C_t}{{}_{R}C_t} = +1 \tag{61}$$

or

$$+\frac{{}_{0}x_t}{{}_{R}C_t} + \frac{{}_{0}\underline{x}_t}{{}_{R}C_t} \equiv \frac{{}_{R}C_t}{{}_{R}C_t} = +1 \tag{62}$$

or

$$+\frac{{}_{0}x_t}{{}_{R}C_t} + \equiv \left(1 - \left(\frac{{}_{0}\underline{x}_t}{{}_{R}C_t}\right)\right) \tag{63}$$

or

$$ {}_0x_t = \left(1 - \left(\frac{{}_0x_t}{{}_RC_t}\right)\right) \times {}_RC_t \tag{64} $$

Multiplying by ${}_RC_t$, we obtain

$$ {}_0x_t \times {}_RC_t = \left(1 - \left(\frac{{}_0x_t}{{}_RC_t}\right)\right) \times {}_RC_t \times {}_RC_t \tag{65} $$

Under conditions where

$$ \boldsymbol{E_0^2} = {}_0x_t \times {}_RC_t \tag{66} $$

and

$$ \boldsymbol{E_R^2} = {}_RC_t \times {}_RC_t \tag{67} $$

it is

$$ \boldsymbol{E_0^2} = \left(1 - \left(\frac{{}_0x_t}{{}_RC_t}\right)\right) \times E_R^2 \tag{68} $$

According to Einstein special theory of relativity it is equally

$$ \boldsymbol{E_0^2} = \left(1 - \left(\frac{\mathrm{v}^2}{c^2}\right)\right) \times E_R^2 \tag{69} $$

The equation before changes to

$$ \left(1 - \left(\frac{\mathrm{v}^2}{c^2}\right)\right) \times E_R^2 = \left(1 - \left(\frac{{}_0x_t}{{}_RC_t}\right)\right) \times E_R^2 \tag{70} $$

Simplifying equation, the general from of negation and 1/(Lorentz factor squared) are identical as

$$ \left(1 - \left(\frac{\mathrm{v}^2}{c^2}\right)\right) = \left(1 - \left(\frac{{}_0x_t}{{}_RC_t}\right)\right) = \frac{+1}{\gamma^2} \tag{71} $$

QUOD ERAT DEMONSTRANDUM.

Remark 3.

According to the theorem before, the Lorentz factor follows as

$$\gamma = \frac{1}{\sqrt[2]{\left(1-\left(\frac{{}_{0}x_{t}}{{}_{R}C_{t}}\right)\right)}} = \frac{+1}{\sqrt[2]{\left(1-\left(\frac{v^{2}}{c^{2}}\right)\right)}} \tag{72}$$

THEOREM 3.5 (1/0 IS DETERMINED BY LORENTZ FACTOR SQUARED)

CLAIM.

The term +1/+0 is defined by the Lorentz factor squared as

$$\gamma^{2} = \left(\frac{+1}{+0}\right) \tag{73}$$

PROOF.

In general, taking axiom 1 to be true, it is

$$+1 \equiv +1 \tag{74}$$

Multiplying by the result of the theorem before, it is

$$\left(1-\left(\frac{v^{2}}{c^{2}}\right)\right) \equiv \left(1-\left(\frac{v^{2}}{c^{2}}\right)\right) \tag{75}$$

or

$$\left(1-\left(\frac{v^{2}}{c^{2}}\right)\right) = \left(1-\left(\frac{{}_{0}x_{t}}{{}_{R}C_{t}}\right)\right) = \frac{+1}{\gamma^{2}} \tag{76}$$

As long as the relative velocity **v is not equal to c**, we obtain

$$\frac{+1}{\left(1-\left(\frac{v^{2}}{c^{2}}\right)\right)} = \frac{+1}{\left(1-\left(\frac{{}_{0}x_{t}}{{}_{R}C_{t}}\right)\right)} \tag{77}$$

Under these conditions, the Lorentz factor squared follows as

$$\gamma^{2} = \frac{1}{\left(1-\left(\frac{v^{2}}{c^{2}}\right)\right)} = \frac{+1}{\left(1-\left(\frac{{}_{0}x_{t}}{{}_{R}C_{t}}\right)\right)} \tag{78}$$

In special relativity, it is of course impossible to accelerate an object to the speed of light c. In other words, an object with **a non zero rest mass** cannot move at the speed of light c. However, there are elementary **massless particles** whose invariant mass is zero. In particle physics, to date the two known massless particles are both gauge bosons: the gluon (carrier of the strong force) and the photon (carrier of electromagnetism) while special relativity is defined even for **the case v=c** (J. P. Barukčić & Barukčić, 2016). In this case it is equally $({}_{0}\underline{X}_{t})=({}_{R}C_{t})$. Whether or not it makes sense to use the laws of special relativity for the case v=c is not the subject of this investigation. However, such an approach is not illogical and not an unreasoned failure and does not demonstrate any flaw in the methodology. Therefore, under conditions where v=c, the equation before changes to

$$\gamma^2 = \frac{1}{\left(1-\left(\frac{c^2}{c^2}\right)\right)} = \frac{+1}{\left(1-\left(\frac{{}_{R}C_t}{{}_{R}C_t}\right)\right)} \tag{79}$$

or to

$$\gamma^2 = \frac{1}{(1-(1))} = \frac{+1}{(1-(1))} \tag{80}$$

or in general to

$$\gamma^2 = \frac{+1}{+0} \tag{81}$$

QUOD ERAT DEMONSTRANDUM.

Remark 4.

Contrary to the axiom 3 of the publication “Classical Logic And The Division By Zero” (I. Barukčić, 2019b), it is not necessary to define 1/0 as an axiom. It appears to be possible to derive 1/0 from lex identitatis. It should be pointed out in this context that *axiom 3* of the unified field theory (I. Barukčić, 2016) can be derived (J. P. Barukčić & Barukčić, 2016) from lex identitatis while *axiom 2* (I. Barukčić, 2016) needs further investigation.

4. Discussion

To date, the common wisdom is that from contradictory premises anything follows (*ex contradictione quodlibet (ECQ)*) with the consequence that it cannot be coherently reasoned about logical inconsistency. Thus far, even paraconsistent logic itself is defined **ex negativo** as any logic which at the same is not explosive. Therefore, ex contradictione quodlibet principle (Carnielli & Marcos, 2001) or principle of explosion which is meanwhile refuted (I. Barukčić, 2019a) does does not imply the correctness of paraconsistent logic as such as advocated especially by the Peruvian philosopher Francisco Miró Quesada and other (da Costa, 1958; Quesada, 1977). In particular, this view lines are of course not a complete survey of paraconsistent logic. However, there is no threat of a logical Armageddon or "explosion" as posed by ex contradictione quodlibet principle (I. Barukčić, 2019a) if a chain of arguments starts with axiom 2 or with the contradiction. In this case and in absence of any technical errors and other errors of human reasoning, the result of a chain of arguments which starts with a contradiction must itself be a contradiction. In other words, **the truth must be preserved** but vice versa too. **The contradiction itself must be preserved too**. This is the fundamental and diametrical difference between *dialectical logic* and *paraconsistent logic*. Similar to modus inversus ***if*** (premise is a contradiction) **then** (conclusion is a contradiction) (I. Barukčić, 2019c). **The Pythagorean theorem** relates rest energy $a^2=E_0{}^2$, $b^2 = E_{Wave}{}^2$ and relativistic energy ${}_RC_t{}^2=E_R{}^2$ as graphically illustrated by Figure 1 and has been used successfully (I. Barukčić, 2019b) to test the claim that 0/0 = 1.

5. Conclusion

Negation and Lorentz factor are more or less identical.

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The author confirms being the sole contributor of this work and has approved it for publication.

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