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General contradiction law and the standard model.

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Abstract

A **triangle** is a basic shape of geometry, there are many types of triangles. In a **scalene triangle** all internal angles are different and all sides have different lengths. A triangle with one internal angle larger than 90° is called an **obtuse triangle.** On the other hand, a triangle with internal angles all smaller than 90° is called an **acute triangle.** In an **equilateral triangle**, all three sides are of equal length. All internal angles of an equilateral triangle are equal—namely, 60°. An equilateral triangle is a special case of an isosceles triangle, but not vice versa. All isosceles triangles are not equilateral triangles. A **isosceles right triangle** is determined by one 90° internal angle, two sides of equal length and two equal internal angles. A **general right-angled triangle** has one 90° internal angle, the right angle. The side opposite to this right angle is called the hypotenuse. The hypotenuse is equally the longest side in a right-angled triangle. The sides a, b and c of such a right-angled triangle satisfy the Pythagorean theorem known as $a^2 + b^2 = c^2$. It was Euclid who presented some elementary facts about triangles. This publication will proof that the Pythagorean theorem is based on General contradiction law which states that

$$\mathbf{X * (Anti\ X) \leq C^2/4}.$$

Key words: Triangle, Pythagorean theorem, Logic, General Contradiction Law.

1. Background

Pythagoras of Samos (Greek: Πυθαγ•ρας; ~ 570 BC – ~ 490 BC), a Greek mathematician and philosopher, "the father of numbers", is best known for discovering the Pythagorean theorem which by tradition bears his name. But as a matter of fact, the history of the Pythagorean theorem is much more complex. Thales of Miletus who had visited Egypt recommended Pythagoras to go to Egypt too. Pythagoras arrived in Egypt when he was just about 23 years old and stayed in Egypt for about 21 years. It was probably in Egypt where Pythagoras learned geometry from Egyptian priests and the theorem that is now called by his name. On the other hand, Baudhayana, an Indian mathematician seems to have discovered the Pythagorean Theorem about 300 years before Pythagoras, too. The Pythagorean theorem is known in China as the so called "Gougu theorem". According to the Pythagorean theorem, in a right-angled triangle it is true that $c^2 = a^2 + b^2$, where c denote the hypotenuse, the side opposite to the right angle, the triangle's longest side. A generalisation of the Pythagorean theorem is the law of cosines, the Pythagorean theorem is just a special case of the law of cosines. The length of a third side of any triangle, given the size of the angle between them and the lengths of two sides is determined according to the law of cosines as $\mathbf{a^2 - (2*a*b*cos(\theta)) + b^2 = c^2}$ **.**

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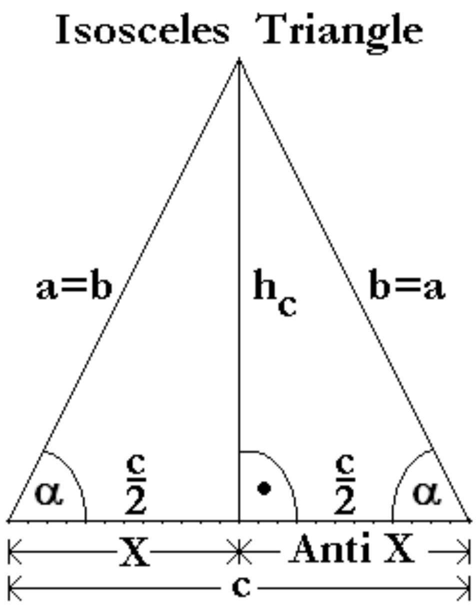
2. Material and Methods

Triangles are helpful to analyse the basic relationship between matter and antimatter, local hidden and local non-hidden variables or in general between X and Anti X. Some of this triangles are the following.

2.1. Isosceles triangle

An **isosceles triangle** has at least two sides of equal length. This triangle also has two equal internal angles. A triangle which has all sides equal is called an equilateral triangle,



where

α	denote the angle between sides *a* and *c*, and between the sides b and c,
a	denote the one side of the triangle, (a =b) > (c/2) ,
b	denote the one side of the triangle, (b = a) > (c/2) ,
c	denote the hypotenuse. Let c = X + (Anti X), thus (c/2) = X = Anti X,
h_c	denote height of the isosceles triangle as illustrated above,
A	denote the area of the isosceles triangle as illustrated above.

The height h_c of the isosceles triangle as illustrated above can be calculated according to the Pythagorean theorem as

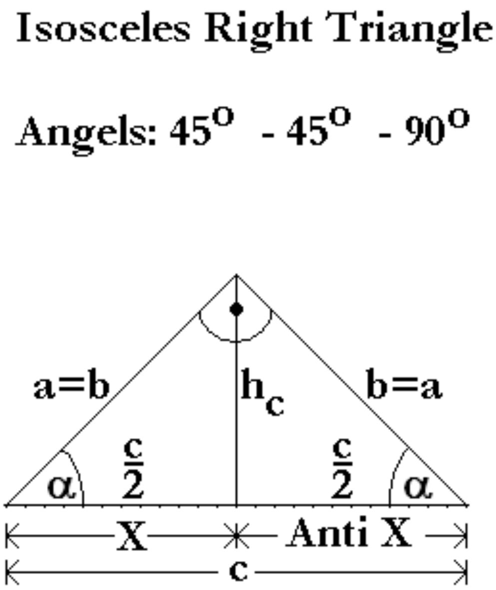
$$h_c = (a^2 - (c / 2)^2)^{1/2} = (a^2 - (X)^2)^{1/2} = (b^2 - (\text{Anti } X)^2)^{1/2} .$$

The area of the isosceles triangle as illustrated above is given by

$$A = (c/2) * h_c = (c/2) * (a^2 - (c / 2)^2)^{1/2} = (c/2) * (a^2 - (X)^2)^{1/2} = (c/2) * (b^2 - (\text{Anti } X)^2)^{1/2} .$$

2.2. Isosceles right triangle

An **isosceles right triangle** has one right angle and two sides of equal length. This triangle also has two equal internal angles of 45^o.



where

α	denote the angle between sides *a* and *c*, and between the sides b and c, $\alpha = 45^o$,
a	denote the one side of the triangle, (a =b) > (c/2) ,
b	denote the one side of the triangle, (b = a) > (c/2) ,
c	denote the hypotenuse. Let c = X + (Anti X), thus (c/2) = X = Anti X,
h_c	denote height of the isosceles right triangle as illustrated above,
A	denote the area of the isosceles right triangle as illustrated above.

The height of the isosceles right triangle as illustrated above can be calculated according to the Pythagorean theorem as

$$h_c = (a^2 - (c / 2)^2)^{1/2} = (a^2 - (X)^2)^{1/2} = (b^2 - (\text{Anti } X)^2)^{1/2} .$$

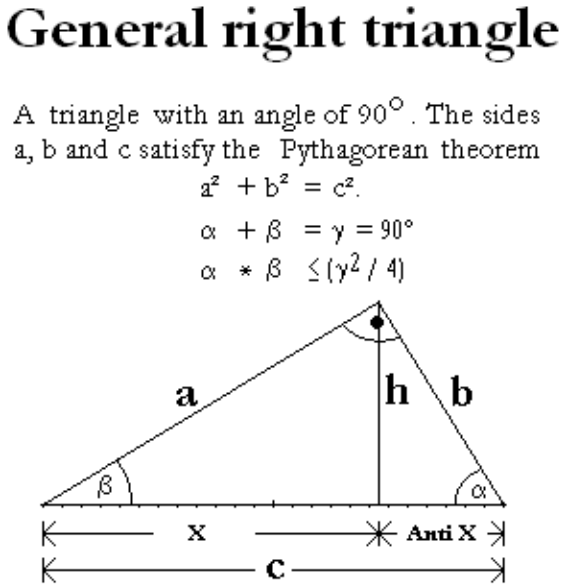
The area of the isosceles right triangle as illustrated above is given by

$$A = (c/2) * h_c = (c/2) * (a^2 - (c / 2)^2)^{1/2} = (c/2) * (a^2 - (X)^2)^{1/2} = (c/2) * (b^2 - (\text{Anti } X)^2)^{1/2} .$$

2.3. General right triangle

A **right triangle** is a triangle with one right angle of 90°. Such a triangle satisfy the Pythagorean theorem which is known as

$$a^2 + b^2 = c^2.$$



where

a	denote the one side of the triangle,
b	denote the other side of the triangle,
c	denote the hypotenuse. Let c = X + (Anti X),
h	denote height of the right triangle as illustrated above,
A	denote the area of the right triangle as illustrated above.

Some **properties** of the right triangle.

$$\mathbf{X + (Anti\ X) = c}. \quad (1)$$

In a right triangle, there is no third between X and Anti X, **tertium non datur**!

$$a^2 + b^2 = c^2 \quad (2)$$

$$a^2 = c * X \quad (3)$$

$$a^2 / c^2 = X / c \quad (4)$$

$$b^2 = c * (Anti\ X) \quad (5)$$

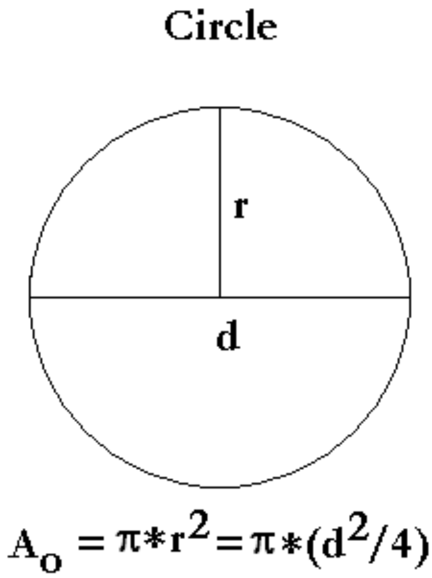
$$b^2 / c^2 = (Anti\ X) / c \quad (6)$$

$$h^2 = (X * Anti\ X) \quad (7)$$

$$A = (1/2) * a * b \quad (8)$$

2.4. Circle

A circle as the unity and the struggle of radius and anti-radius finds its completion by the power of π in the area of the circle. A unit circle is a circle with a unit radius r, i.e., a circle whose radius r =1.



where

d	denote the diameter of a circle. Let d = 2 * r = r + r,
r	denote the radius of a circle,
π	denote the mathematical constant π, also known as **Archimedes' constant,**
U	denote the length of a circle's circumference,
A_o	denote the area enclosed by a circle illustrated above.

Some **properties** of a circle.

$$A_o = \pi * r^2 \qquad (9)$$

$$A_o = \pi * (d^2 / 4) \qquad (10)$$

$$r^2 = (d^2 / 4) \qquad (11)$$

$$d = 2 * (A / \pi)^{1/2} \qquad (12)$$

$$U = 2 * \pi * r \qquad (13)$$

3. Results

3.1. Pythagorean theorem is based on the general contradiction law

The foundation of the Pythagorean theorem.

a denote the one side of the right triangle,

b denote the other side of the right triangle,

c denote the hypotenuse of the right triangle. Recall, c = X + (Anti X),

X denote X, the local non-hidden variable,

Anti X denote Anti X, the local hidden variable, the otherness of X,

then

$$\mathbf{a^2 + b^2 = c^2.}$$

Proof

$$\mathbf{+X = +X} \quad (14)$$

$$X + (\text{Anti } X) = X + (\text{Anti } X) \quad (15)$$

$$\mathbf{X + (\text{Anti } X) = c} \quad (16)$$

$$X*c + (\text{Anti } X)*c = c*c \quad (17)$$

In accordance with Eq. (4) it is true that $b^2 = c*(\text{Anti } X)$. We obtain the next equation.

$$X*c + b^2 = c^2 \quad (18)$$

In accordance with Eq. (3) it is true that $a^2 = (c*X)$. We obtain the next equation.

$$\mathbf{a^2 + b^2 = c^2.} \quad (19)$$

Q. e. d.

3.1.1. Pythagorean theorem and the area of a square in Euclidean geometry

In Euclidean geometry, a **square** has four equal sides, four right angles, and parallel opposite sides.

Pythagorean theorem and the area of a square.

a	denote the length of each of the four equal sides of a square **A** in plane (Euclidean) geometry,
b	denote the length of each of the four equal sides of a square **B** in plane (Euclidean) geometry,
c	denote the length of each of the four equal sides of a square **C** in plane (Euclidean) geometry,
A(□)	denote the area of a square A in plane (Euclidean) geometry, where A(□) = a^2,
B(□)	denote the area of a square B in plane (Euclidean) geometry, where B(□) = b^2,
C(□)	denote the area of a square C in plane (Euclidean) geometry, where C(□) = c^2,

then

A(□) + B(□) = C(□).

Proof

Our starting point is the Pythagorean theorem.

$$\mathbf{a^2 + b^2 = c^2} \qquad (20)$$

Recall.

$$A(\square) = a^2. \qquad (21)$$

$$B(\square) = b^2. \qquad (22)$$

$$C(\square) = c^2. \qquad (23)$$

We obtain the next equation.

$$\mathbf{A(\square) + B(\square) = C(\square).} \qquad (24)$$

Q. e. d.

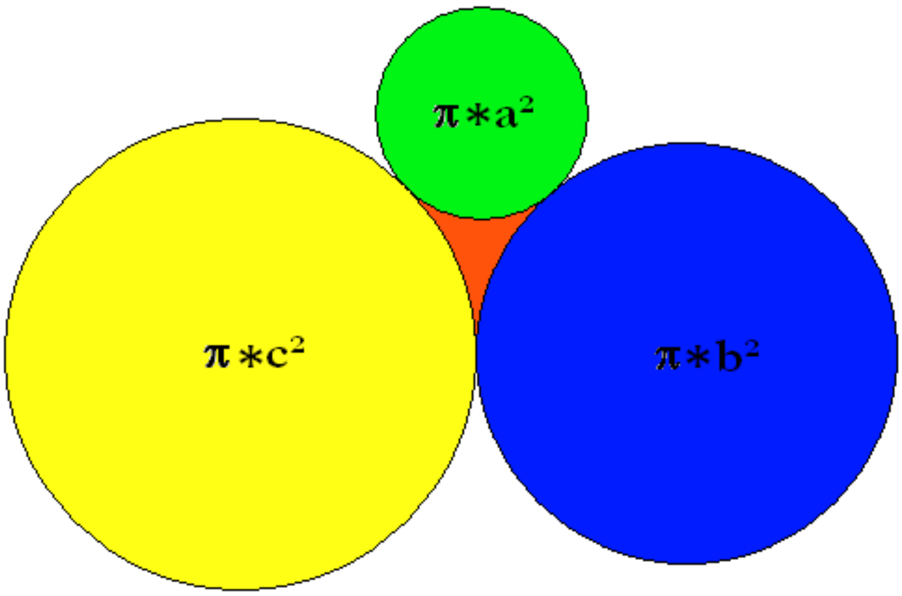
Tertium non datur, the law of the excluded middle and thus classical logic is the foundation of Pythagoras theorem. There is no third area between the area A(□) of a square A and the area B(□) of an other square B if it is true that A(□) + B(□) = C(□). Pythagoras theorem is only a translation of the law of the excluded middle into geometry. In so far, logic is valid for fields too. But be careful, the area A(□) can be unequal to B(□) and vice versa, which leads to the general contradiction law.

The foundation of the Pythagorean theorem III.

a	denote the one side of the right triangle,
b	denote the other side of the right triangle,
c	denote the hypotenuse of the right triangle. Let c = X + (Anti X),
X	denote X, the local non-hidden variable,
Anti X	denote Anti X, the local hidden variable, the otherness of X,
A(○)	denote the area of the circle A,
B(○)	denote the area of the circle B,
C(○)	denote the area of the circle C,

then

A(○) + B(○) = C(○).



Proof

$$+\mathbf{X} = +\mathbf{X} \quad (25)$$

$$X + (\text{Anti } X) = X + (\text{Anti } X) \quad (26)$$

$$\mathbf{X + (\text{Anti } X) = c} \quad (27)$$

$$X*c + (\text{Anti } X)*c = c*c \quad (28)$$

In accordance with Eq. (4) it is true that $b^2 = c*(\text{Anti } X)$. We obtain the next equation.

$$X*c + b^2 = c^2 \quad (29)$$

In accordance with Eq. (3) it is true that $a^2 = (c^* X)$. We obtain the next equation.

$$a^2 + b^2 = c^2 \qquad (30)$$

Let us assume that a, b, c denotes the radius a circle A, B, C too.
The area of a square can be converted into the area of a circle.

$$\pi^* a^2 + \pi^* b^2 = \pi^* c^2 \qquad (31)$$

Set A(○) =$\pi^* a^2$. B(○) = $\pi^* b^2$. C(○) = $\pi^* c^2$. (32)

A(○) + B(○) = C(○). (33)

Q. e. d.

Pythagoras theorem is valid for a circle too and is based on the law of the excluded middle. If we reduce the area of a sphere to the area of a square, we can see, that the same is based on the Pythagorean theorem too.

The foundation of the Pythagorean theorem IV.

a	denote the one side of the right triangle, here: the radius of the sphere A too,
b	denote the other side of the right triangle, here: the radius of the sphere B too,
c	denote the hypotenuse of the right triangle. here: the radius of the sphere C too. Let c = X + (Anti X),
X	denote X, the local non-hidden variable,
Anti X	denote Anti X, the local hidden variable, the otherness of X,
A(🌍)	denote the area of the sphere A,
B(🌍)	denote the area of the sphere B,
C(🌍)	denote the area of the sphere C,

then

A(🌍) + B(🌍) = C(🌍).

Proof

+X = +X (34)

X + (Anti X) = X + (Anti X) (35)

X + (Anti X) = c (36)

$$X*c + (\text{Anti } X)*c = c*c \qquad (37)$$

In accordance with Eq. (4) it is true that $b^2 = c*(\text{Anti } X)$. We obtain the next equation.

$$X*c + b^2 = c^2 \qquad (38)$$

In accordance with Eq. (3) it is true that $a^2 = (c* X)$. We obtain the next equation.

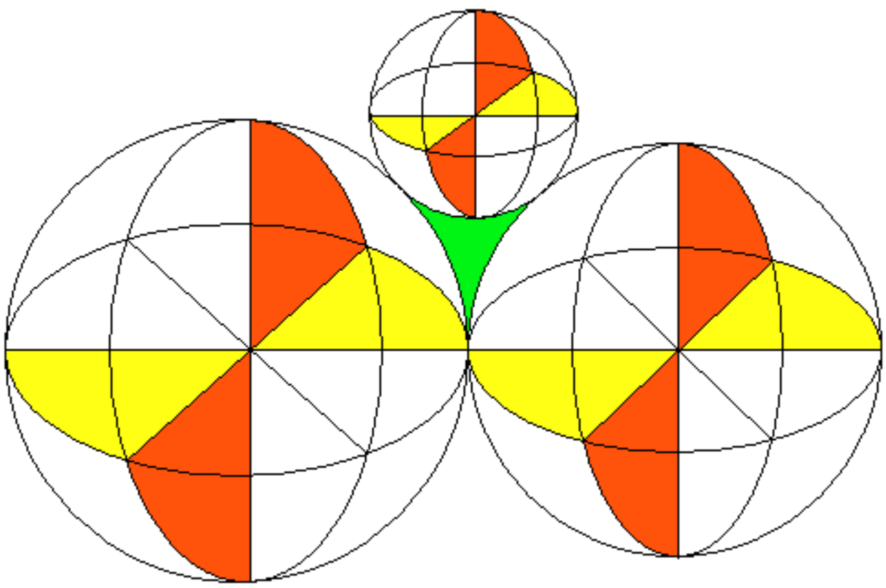
$$a^2 + b^2 = c^2 \qquad (39)$$

Recall that a, b, c denote the radius of a sphere A, B, C too.
The area of a square can thus be converted into the area of a sphere and vice versa.

$$4*\pi*a^2 + 4*\pi*b^2 = 4*\pi*c^2 \qquad (40)$$

Set A(🌍) $=4*\pi*a^2$. B(🌍) $= 4*\pi*b^2$. C(🌍) $= 4*\pi*c^2$. (41)

A(🌍) + B(🌍) = C(🌍). (42)



Q. e. d.

Pythagoras theorem is valid for the area of a sphere too and is based on the law of the excluded middle.

3.1.2. Pythagorean theorem the general contradiction law

The Pythagorean theorem is based on classical logic and thus on the general contradiction law (Barukčić, 2006e) too.

Pythagorean theorem and the general contradiction law I.

a	denote the length of each of the four equal sides of a square **A** in plane (Euclidean) geometry,
b	denote the length of each of the four equal sides of a square **B** in plane (Euclidean) geometry,
c	denote the length of each of the four equal sides of a square **C** in plane (Euclidean) geometry,
A(□)	denote the area of a square A in plane (Euclidean) geometry, where A(□) = a²,
Anti A(□)	denote the Anti area of a square Anti A in plane (Euclidean) geometry, where Anti A(□) = B(□) = C(□) - A(□),
B(□)	denote the area of a square B in plane (Euclidean) geometry, where B(□) = b²,
C(□)	denote the area of a square C in plane (Euclidean) geometry, where C(□) = c²,
	let A(□) ≥ B(□),

then

$$A(\square) * (\text{Anti } A(\square)) \leq C(\square)^2 / 4 .$$

Proof

$$A(\square) \geq B(\square) \quad (43)$$

$$A(\square) + A(\square) \geq B(\square) + A(\square) \quad (44)$$

$$2 * A(\square) \geq C(\square) \quad (45)$$

$$A(\square) \geq C(\square)/2 \quad (46)$$

$$A(\square) - (C(\square)/2) \geq 0 \quad (47)$$

$$(A(\square) - (C(\square)/2))^2 \geq 0^2 \quad (48)$$

$$A(\square)^2 - (A(\square) * C(\square)) + (C(\square)^2/4) \geq 0^2 \quad (49)$$

$$A(\square)^2 - (A(\square) * C(\square)) \geq -(C(\square)^2/4) \quad (50)$$

$$-A(\square)^2 + (A(\square) * C(\square)) \leq (C(\square)^2/4) \quad (51)$$

$$+(A(\square) * C(\square)) - A(\square)^2 \leq (C(\square)^2/4) \quad (52)$$

$$A(\square) * (C(\square) - A(\square)) \leq (C(\square)^2/4) \quad (53)$$

$$A(\square) * B(\square) \leq (C(\square)^2/4) \quad (54)$$

Recall. Anti A(□) = B(□) = C(□) - A(□).

$$\mathbf{A(\square) * (\text{Anti } A(\square)) \leq C(\square)^2 / 4} \quad (55)$$

Q. e. d.

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Binding energy and the general contradiction law.

According to the general contradiction law, a whole that is constituted out of parts, out of X and Anti X, seems to be at lower energy level than its unbound constituents, than its constituent parts. This seems to be one of the most basic laws of nature.

According to Einstein's equivalence of mass and energy or **energy = mass***c², the mass m_H of a whole that is constituted out of X and Anti X should be equally less then the mass m_S of its unbound constituents. This "lost" mass after binding X and Anti X together may be small, but there should be one. The missing mass does not vanish into nothing.

$$E_B = \Delta m * c^2 = (m_S - m_H) * c^2 = E_S - E_H ,$$

where

Δm	denote the mass defect of X and Anti X,
E_B	denote the binding energy between X and Anti X,
m_H	denote the mass of a whole that is constituted out of parts, out of X and Anti X,
E_H	denote the energy of a whole that is constituted out of parts, out of X and Anti X,
m_S	denote the mass of separated X and Anti X,
E_S	denote the energy of separated X and Anti X,
u	denote the atomic mass unit (1.000000 **u**), where 1 u is define as 1/12 of the mass of a ^{12}C atom. Set

$A(\square) = E_H ,$

$\text{Anti } A(\square) = E_B = B(\square) = C(\square) - A(\square) = E_S - E_H ,$

$B(\square) = E_B ,$

$C(\square) = E_S = E_B + E_H.$

According to the general contradiction law it is equally true that

$$A(\square) * (\text{Anti } A(\square)) \leq C(\square)^2 / 4 .$$

Energy is need to separate a whole into separate parts, to separate X from Anti X. An atom can be disassembled into free electrons and a nucleus. A nucleus can be disassembled into free protons and neutrons etc. The deuteron is constituted out of one proton and one neutron. The rest-energy of deuteron is known to be $A(\square) =$ 1875,63 MeV. The rest energy of proton is known to be 938.28 MeV. The rest energy of neutron is known to be 939.57 MeV. Recall, 1875,63 MeV < (938.28 MeV + 939.57 MeV) . The difference is about $\text{Anti } A(\square) =$ 2.22 MeV which is the binding energy of the deuteron nucleus. The energy required to disassemble a whole that is constituted out of X and Anti X into its unbound constituents, a nucleus into free unbound parts like protons and neutrons, can be calculated according to the general contradiction law according to Eq. (55) as

$$\text{Anti } A(\square) \leq C(\square)^2 / (4 * A(\square)).$$

$$\text{Anti } A(\square) \leq (938.28 \text{ MeV} + 939.57 \text{ MeV})^2 / (4 * 1875{,}63 \text{ MeV}).$$

$$\text{Anti } A(\square) \leq ((938.28 + 939.57) * (938.28 + 939.57) / (4 * 1875.63) = 470{,}018156899282 \text{ MeV}.$$

The result is correct, since $\text{Anti } A(\square) =$ 2.22 MeV which is less then 470,018156899282 MeV.

Pythagorean theorem and the general contradiction law II.

a	denote the length of each of the four equal sides of a square **A** in plane (Euclidean) geometry,
b	denote the length of each of the four equal sides of a square **B** in plane (Euclidean) geometry,
c	denote the length of each of the four equal sides of a square **C** in plane (Euclidean) geometry,
$A(\square)$	denote the area of a square A in plane (Euclidean) geometry, where $A(\square) = a^2$,
Anti $A(\square)$	denote the Anti area of a square Anti A in plane (Euclidean) geometry, where Anti $A(\square) = C(\square) - B(\square)$,
$B(\square)$	denote the area of a square B in plane (Euclidean) geometry, where $B(\square) = b^2$,
$C(\square)$	denote the area of a square C in plane (Euclidean) geometry, where $C(\square) = c^2$,
	let $B(\square) \geq A(\square)$,

then

$$\mathbf{A(\square) * (Anti\ A(\square)) \leq C(\square)^2 / 4.}$$

Proof

$$B(\square) \geq A(\square) \quad (56)$$

$$B(\square) + B(\square) \geq A(\square) + B(\square) \quad (57)$$

$$2 * B(\square) \geq C(\square) \quad (58)$$

$$B(\square) \geq C(\square)/2 \quad (59)$$

$$B(\square) - (C(\square)/2) \geq 0 \quad (60)$$

$$(B(\square) - (C(\square)/2))^2 \geq 0^2 \quad (61)$$

$$B(\square)^2 - (B(\square)* C(\square)) + (C(\square)^2/4) \geq 0^2 \quad (62)$$

$$B(\square)^2 - (B(\square)* C(\square)) \geq - (C(\square)^2/4) \quad (63)$$

$$- B(\square)^2 + (B(\square)* C(\square)) \leq (C(\square)^2/4) \quad (64)$$

$$+ (B(\square)* C(\square)) - B(\square)^2 \leq (C(\square)^2/4) \quad (65)$$

$$B(\square) * (C(\square) - B(\square)) \leq (C(\square)^2/4) \quad (66)$$

$$B(\square) * (\quad A(\square) \quad) \leq (C(\square)^2/4) \quad (67)$$

$$(B(\square) = b^2) * (A(\square) = \mathbf{a}^2) \leq (C(\square) = c^2)^2 / 4 \quad (68)$$

$$b^2 * a^2 \leq (c^2)^2 / 4 \quad (69)$$

Recall. $B(\square) = C(\square) - A(\square)$.

$$(C(\square) - A(\square)) * A(\square) \leq (C(\square)^2/4) \quad (70)$$

Recall. Anti $A(\square) = B(\square) = C(\square) - A(\square)$.

$$(Anti\ A(\square)) * A(\square) \leq (C(\square)^2/4) \quad (71)$$

$$\mathbf{A(\square) * (Anti\ A(\square)) \leq C(\square)^2 / 4} \quad (72)$$

Q. e. d.

3.2. The inner contradiction of the right triangle

The inner contradiction of the right triangle I.

Let

a denote the one side of the right triangle,
b denote the other side of the right triangle,
c denote the hypotenuse of the right triangle. Let c = X + (Anti X),
h denote height of the right triangle as illustrated above,
Δ(Anti X) ² denote the inner contradiction Δ(Anti X)² of the right triangle,

then

$$\boldsymbol{\Delta(\text{Anti } X)^2 = h^2 = (a^2 * b^2)/c^2.}$$

Proof

$$\boldsymbol{a^2 = c * X} \qquad (73)$$

which is in accordance with Eq. (3).

$$a^2/c^2 = c*X/c^2 \qquad (74)$$

$$a^2/c^2 = X/c \qquad (75)$$

$$a^2 = c * (c - (\text{Anti } X)) \qquad (76)$$

$$a^2 / c = (c - (\text{Anti } X)) \qquad (77)$$

$$((\text{Anti } X) * a^2) / c = (\text{Anti } X) *(c - (\text{Anti } X)) \qquad (78)$$

$((\text{Anti } X) / c) = (b^2/c^2)$ which in accordance with Eq. (6). We obtain the next equation.

$$(b^2 * a^2)/c^2 = (\text{Anti } X) *(c - (\text{Anti } X)) \qquad (79)$$

The inner contradiction Δ(Anti X)² is defined in accordance with Barukčić (Barukčić 2007d, p. 26, Eq. (66)) as

$$\Delta(\text{Anti } X)^2 =(\text{Anti } X) *(c - (\text{Anti } X)).$$

We obtain the next equation as the inner contradiction Δ(Anti X)² of the right triangle.

$$\Delta(\text{Anti } X)^2 = h^2 = (a^2 * b^2) / c^2 = (\text{Anti } X) *(c - (\text{Anti } X)). \qquad (80)$$

Q. e. d.

The inner contradiction of the right triangle II.

Let

a denote the one side of the right triangle,

b denote the other side of the right triangle,

c denote the hypotenuse of the right triangle. Let c = X + (Anti X),

h denote the height of the right triangle as illustrated above,

$\Delta(X)^2$ denote the inner contradiction $\Delta(X)^2$ of the right triangle,

then

$$\mathbf{\Delta(X)^2 = (a^2 * b^2) / c^2 = h^2 = X *(c - X).}$$

Proof

$$\mathbf{b^2 = c * (Anti\ X)} \quad (81)$$

which is in accordance with Eq. (3).

$$b^2/c^2 = c*(Anti\ X)/c^2 \quad (82)$$

$$b^2/c^2 = (Anti\ X)/c \quad (83)$$

$$b^2 = c * (c - X) \quad (84)$$

$$b^2 / c = (c - X) \quad (85)$$

$$(X * b^2) / c = X *(c - X) \quad (86)$$

(X / c) = (a^2/c^2) which in accordance with Eq. (4). We obtain the next equation.

$$(a^2 * b^2)/c^2 = X *(c - X) \quad (87)$$

The inner contradiction $\Delta(X)^2$ is defined in accordance with Barukčić (Barukčić 2007d, p. 26, Eq. (66)) as

$$\Delta(X)^2 = X *(c - X).$$

We obtain the next equation as the inner contradiction $\Delta(X)^2$ of the right triangle.

$$\Delta(X)^2 = h^2 = (a^2 * b^2) / c^2 = X *(c - X) \quad (88)$$

Q. e. d.

It is a remarkable fact, that the inner contradiction of X is equal to the inner contradiction of its own Anti-X or $\Delta(X)^2 = (a^2 * b^2) / c^2 = \Delta(Anti\ X)^2$. Recall, set c = 0 then $\Delta(X)^2 = - X^2$!

3.3. The variance of the right triangle

The variance of the right triangle I.

Let

a	denote the one side of the right triangle,
b	denote the other side of the right triangle,
c	denote the hypotenuse of the right triangle. Let c = X + (Anti X),
h	denote height of the right triangle as illustrated above,
Δ(Anti X) ^{2}	denote the inner contradiction Δ(Anti X)^2 of the right triangle,
σ(Anti X)^2	denote the variance σ(Anti X)^2 of the right triangle,

then

$$\sigma(\text{ Anti X })^2 = \Delta(\text{ Anti X })^2 / c^2 = h^2 / c^2 = (a^2 * b^2)/(c^4).$$

Proof

$$a^2 = c * X \quad (89)$$

$$a^2/c^2 = c*X/c^2 \quad (90)$$

$$a^2/c^2 = X/c \quad (91)$$

$$a^2 = c * (c - (\text{ Anti X })) \quad (92)$$

$$a^2 / c = (c - (\text{ Anti X })) \quad (93)$$

$$((\text{Anti X }) * a^2) / c = (\text{Anti X }) *(c - (\text{ Anti X })) \quad (94)$$

Recall. That ((Anti X) / c) = (b^2/c^2). We obtain the next equation.

$$(b^2 * a^2)/c^2 = (\text{Anti X }) *(c - (\text{ Anti X })) \quad (95)$$

The inner contradiction Δ(Anti X)^2 is defined in accordance with Barukčić (Barukčić 2007d, p. 26, Eq. (66)) as

$$\Delta(\text{ Anti X })^2 =(\text{Anti X }) *(c - (\text{ Anti X })).$$

We obtain the next equation as the inner contradiction Δ(Anti X)^2 of the right triangle.

$$\Delta(\text{ Anti X })^2 = (a^2 * b^2) / c^2 = (\text{Anti X }) *(c - (\text{ Anti X })) \quad (96)$$

The variance of Anti X denoted as σ(Anti X)^2 is defined as σ(Anti X)^2 = Δ(Anti X)^2 / c^2 = (Anti X)*(c - (Anti X))/c^2 in accordance with Barukčić (Barukčić 2007d, p. 27, Eq. (77) and Eq. (78)). We obtain the next equation.

$$\sigma(\text{ Anti X })^2 = \Delta(\text{ Anti X })^2 / c^2 = (a^2 * b^2)/(c^4) = h^2 / c^2 = (\text{Anti X})*(c - (\text{ Anti X }))/c^2 \quad (97)$$

Q. e. d.

Recall, set **c = 0** then Δ(Anti X)^2 = - (Anti X)^2!

The variance of the right triangle II.

Let

a	denote the one side of the right triangle,
b	denote the other side of the right triangle,
c	denote the hypotenuse of the right triangle. Let c = X + (Anti X). Let
h	denote height of the right triangle as illustrated above,
$\Delta(X)^2$	denote the inner contradiction $\Delta(X)^2$ of the right triangle,
$\sigma(X)^2$	denote the variance $\sigma(X)^2$ of the right triangle,

then

$$\boldsymbol{\sigma(X)^2 = \Delta(X)^2 / c^2 = (a^2 * b^2)/(c^4) = h^2 / c^2 = X*(c - X)/c^2 .}$$

Proof

$$\mathbf{b^2 = c * (Anti\ X)} \qquad (98)$$

which is in accordance with Eq. (3).

$$b^2/c^2 = c*(Anti\ X)/c^2 \qquad (99)$$

$$b^2/c^2 = (Anti\ X)/c \qquad (100)$$

$$b^2 = c * (c - X) \qquad (101)$$

$$b^2 / c = (c - X) \qquad (102)$$

$$(X * b^2) / c = X *(c - X) \qquad (103)$$

$(X / c) = (a^2/c^2)$ which in accordance with Eq. (4). We obtain the next equation.

$$(a^2 * b^2)/c^2 = X *(c - X) \qquad (104)$$

The inner contradiction $\Delta(X)^2$ is defined in accordance with Barukčić (Barukčić 2007d, p. 26, Eq. (66)) as

$$\Delta(X)^2 = X *(c - X).$$

We obtain the next equation as the inner contradiction $\Delta(X)^2$ of the right triangle.

$$\Delta(X)^2 = (a^2 * b^2) / c^2 = h^2= X *(c -X) \qquad (105)$$

The variance of X denoted as $\sigma(X)^2$ is defined as $\sigma(X)^2 = \Delta(X)^2 / c^2 = X*(c - X)/c^2$ in accordance with Barukčić (Barukčić 2007d, p. 27, Eq. (77) and Eq. (78)). We obtain the next equation.

$$\boldsymbol{\sigma(X)^2 = \Delta(X)^2 / c^2 = (a^2 * b^2)/(c^4) = h^2 / c^2 = X*(c - X)/c^2} \qquad (106)$$

Q. e. d.

3.4. The area of the right triangle

3.4.1. The unity and the struggle of X and Anti X.

The unity and the struggle of X and Anti X.

Let

a	denote the one side of the right triangle,
b	denote the other side of the right triangle,
c	denote the hypotenuse of the right triangle. Let c = X + (Anti X) ≠ 0. Let
h	denote height of the right triangle as illustrated above,
X	X denote the local non-hidden part of c of the right triangle,
Anti X	denote the local hidden part of c of the right triangle,
A (Δ)	denote the area of the right triangle,

then

$$4 * A (\Delta)^2 = (c^2 * X * (\text{Anti } X)) = (a^2 * b^2).$$

Proof

$$\boldsymbol{\Delta(X)^2 = X * (\text{Anti } X) = (a^2 * b^2)/(c^2)} \qquad (107)$$

which is in accordance with Eq. (88).

$$c^2 * X * (\text{Anti } X) = (a^2 * b^2) \qquad (108)$$

$$(c^2 * X * (\text{Anti } X))^{1/2} = (a * b) \qquad (109)$$

$$A (\Delta) = (c^2 * X * (\text{Anti } X))^{1/2} / 2 = (a * b)/2 \qquad (110)$$

$$4 * A (\Delta)^2 = (c^2 * X * (\text{Anti } X)) = (a^2 * b^2) \qquad (111)$$

Q. e. d.

3.4.2. The covariance and the general right triangle.

Let us take a view on the Pythagorean theorem by the 2 by 2 table.

		c		
		Anti X	X	
c	X	(X * Anti X)	$(X)^2$	a^2
	Anti X	$(\text{Anti } X)^2$	(X * Anti X)	Anti a^2
		b^2	Anti b^2	c^2

Recall:

$$b^2 = c*(\text{Anti } X) \qquad (112)$$

$$b^2 = (X + (\text{Anti } X))*(\text{Anti } X) \qquad (113)$$

$$b^2 = (X *(\text{Anti } X)) + (\text{Anti } X)^2 \qquad (114)$$

Recall:

$$a^2 = c*(X) \qquad (115)$$

$$a^2 = (X + (\text{Anti } X))*(X) \qquad (116)$$

$$a^2 = (X *(\text{Anti } X)) + (X)^2 \qquad (117)$$

Recall:

$$(X + \text{Anti } X) = C \qquad (118)$$

$$(X + \text{Anti } X)^2 = C^2 \qquad (119)$$

$$\mathbf{(X)^2 + (2*((X *(\text{Anti } X)))) + (\text{Anti } X)^2 = C^2} \qquad (120)$$

$$(2*((X *(\text{Anti } X)))) = C^2 - (X)^2 - (\text{Anti } X)^2 \qquad (121)$$

$$(X *(\text{Anti } X)) = \mathbf{(C^2 - (X)^2 - (\text{Anti } X)^2) / 2 \leq (C^2/4)} \qquad (122)$$

$$\mathbf{(X)^2 + (\text{Anti } X)^2 \geq C^2/2} \qquad (122a)$$

$$C^2*(X (\text{Anti } X)) = C^2*(C^2 - (X)^2 - (\text{Anti } X)^2) / 2 \qquad (123)$$

$$C^2*(X (\text{Anti } X)) = C^2*(C^2 - (X)^2 - (\text{Anti } X)^2) / 2 = a^2 * b^2 \qquad (124)$$

$$4 * A (\Delta)^2 = C^2*(X (\text{Anti } X)) = C^2*(C^2 - (X)^2 - (\text{Anti } X)^2) / 2 = a^2 * b^2 \qquad (125)$$

$$A (\Delta)^2 / (X (\text{Anti } X)) = C^2 / 4 \qquad (126)$$

The covariance and the general right triangle.

Let

a	denote the one side of the right triangle,
b	denote the other side of the right triangle,
c	denote the hypotenuse of the right triangle. Let c = X + (Anti X) ≠ 0. Let
X	X denote the local non-hidden part of c of the right triangle,
Anti X	denote the local hidden part of c of the right triangle,
A (Δ)	denote the area of the right triangle,
σ (X, Anti X)	denote the covariance of X and Anti X,

then

$$\boldsymbol{\sigma (X , Anti\ X)} = (c^2*X*(Anti\ X) - (a^2 * b^2)) / (c^2 * c^2) = 0.$$

Proof

$$a = a \quad (127)$$

$$a^2 = a^2 \quad (128)$$

$$a^2*1 = a^2 \quad (129)$$

Set $b^2 \neq 0$. Thus, $b^2/b^2 = 1$.

$$a^2*(b^2/b^2) = a^2 \quad (130)$$

$$a^2 * b^2 = a^2 * b^2 \quad (131)$$

According to Eq. (111) it is true that $c^2*(X*(Anti\ X)) = a^2*b^2$. We obtain the next equation.

$$c^2*(X*(Anti\ X)) = a^2 * b^2 \quad (132)$$

$$(c^2*(X*(Anti\ X))) / (c^2*c^2) = (a^2 * b^2) / (c^2*c^2) \quad (133)$$

$$(c^2*(X*(Anti\ X))) / (c^2*c^2) - (a^2 * b^2) / (c^2*c^2) = 0 \quad (134)$$

$$(c^2*X*(Anti\ X) - (a^2 * b^2)) / (c^2 * c^2) = 0 \quad (135)$$

$$\boldsymbol{\sigma (X , Anti\ X)} = (c^2*X*(Anti\ X) - (a^2 * b^2)) / (c^2 * c^2) = 0. \quad (136)$$

which is in accordance with Eq. (88).

It should be easy to calculate that

$$| \sigma(X, Anti\ X) / (\sigma(X) * \sigma (Anti\ X)) | = 1.$$

3.5. The circle as the unity and the struggle of radius and Anti radius.

The foundation of a circle.

Let

r	denote the radius of a circle, the local non-hidden radius of a circle,
Anti r	denote the Anti radius of a circle, the local hidden radius of a circle, the otherness of the radius of a circle,
d	denote the diameter of a circle. Let d = r + Anti r. Thus, Anti r = d - r. Let

$$\mathbf{r = Anti\ r},$$

then

$$\mathbf{r * (Anti\ r) = d^2 /4.}$$

Proof

$$\mathbf{r = Anti\ r} \quad (137)$$

$$r + r = r + (Anti\ r) \quad (138)$$

$$2*r = r + (Anti\ r) = d \quad (139)$$

$$r = (d / 2) \quad (140)$$

$$(r - (d / 2))^2 = 0^2 \quad (141)$$

$$r^2 - (r*d) + (d^2 / 4) = 0 \quad (142)$$

$$r^2 - (r*d) = - (d^2 / 4) \quad (143)$$

$$(r * d) - r^2 = (d^2 / 4) \quad (144)$$

$$r* (d - r) = d^2 /4 \quad (145)$$

Since d - r = r we obtain the next equation.

$$\mathbf{r^2 = d^2 /4} \quad (146)$$

Since d - r = Anti r too we obtain the next equation.

$$\mathbf{r * (Anti\ r) = d^2 /4} \quad (147)$$

Q. e. d.

A circle is not only a simple and closed curve, it is the unity of radius (X) and Anti radius (Anti X), a unity of two that are different and equal to each other, a unity of opposites. The one is not dominant over its own other and vice versa. If r > Anti r or if Anti r > r then the circle will pass over into an inequality and we obtain equally $\mathbf{r * (Anti\ r) \leq d^2 /4}$. The circle is determined by the relationship between r and Anti r. π has the power to unite r and Anti r into a circle, without π, r and Anti r would not able unite within a circle.

3.6. Relativistic energy-momentum.

Relativistic energy-momentum and Pythagorean theorem.

Let

$E_t = (m_r*c^2)$	denote the total energy of an object in motion. Recall, the total energy of a moving body can be calculated according to Einstein through the formula $E_t = (m_o / (1 - (v^2/c^2))^{1/2}) * c^2)$,	(148)
m_r	denote the relativistic mass, a mass depending on one's frame of reference, a mass that may vary depending on the observer's inertial frame,	
$E_o = (m_o*c^2)$	denote the rest energy, the **non-zero energy** of an object at rest ($v = 0$ and $\gamma = (1- (v^2/c^2))^{1/2} = 1$),	(149)
m_o	denote the rest mass (invariant mass), a mass which does not change with the observer, a mass that does not change with a change of the reference system,	
$E_k = (p_r * c)$	denote the kinetic energy of an object in motion. Recall, the energy momentum relation of an object that is massless (e.g., photon) reduces to $E_t = p_r * c$.	(150)
p_r	denote the relativistic momentum. Recall, the momentum of a body in its rest frame is zero. Let	
c	denote the speed of light in a vacuum,	
v	denote the relative velocity between the observer and the object,	
$\gamma = (1- (v^2/c^2))^{1/2}$	denote the Lorentz factor,	(151)
$(E_t)^2 = (p_r*c)^2 + (m_o*c^2)^2$	denote the relativistic energy and momentum. The relativistic energy and momentum can be calculated according to the formula $(E_t)^2 - (p_r*c)^2 = (m_o*c^2)^2$. The total energy of an object in motion $(E_t)^2$ and the relativistic momentum (p_r) vary from frame to frame and are observer dependent. In opposite to this, $(m_o*c^2)^2$ is observer independent.	(152)
A	denote one side of a general right triangle,	
B	denote one side of a general right triangle,	
C	denote the hypotenuse of a general right triangle. Recall, that $C = X + (\text{Anti } X) \neq 0$. Let	
$(E_t)^2 = (m_t*c^2)^2 = C^2$	according to Eq. (148),	(153)
$(E_k)^2 = (p_r * c)^2 = A^2$	according to Eq. (150),	(154)
$(E_o)^2 = (m_o*c^2)^2 = B^2$	according to Eq. (149),	(155)
X	denote the local non-hidden part of the hypotenuse C of a general right triangle, or the local non-hidden part of the relativistic energy–momentum relation,	
Anti X	denote the local hidden part of the hypotenuse C of a general right triangle, or the local hidden part of the relativistic energy–momentum relation,	

$A^2 = C*X$	according to Eq. (3),	(156)
$B^2 = C*(Anti\ X)$	according to Eq. (5),	(157)
$\Delta(X)^2$	denote the inner contradiction of a general right triangle or of the relativistic energy–momentum relation,	
$\sigma(X)^2$	denote the variance of the relativistic energy–momentum relation. Recall, according to Eq. (106),	

$$\sigma(X)^2 = \Delta(X)^2 / C^2 = (A^2 * B^2)/(C^4) = (X*(Anti\ X))/C^2 \qquad (158)$$

then

$$\boldsymbol{\sigma(X)^2 = (v^2 *(c^2 - v^2)) / c^4}$$

Proof

$$\mathbf{X = X} \qquad (159)$$

$$X + (Anti\ X) = X + (Anti\ X) \qquad (160)$$

$$X + (Anti\ X) = C \qquad (161)$$

$$C*X + C*(Anti\ X) = C \qquad (162)$$

$$A^2 \quad + \quad B^2 \quad = \quad C^2 \qquad (163)$$

$$(p_r*c)^2 + (m_o*c^2)^2 = (E_t)^2 \qquad (164)$$

(1)	(2)	
$A^2 = C*X = (p_r*c)^2$	$B^2 = C*(Anti\ X)=(m_o*c^2)^2$	(165)
$X = (p_r*c)^2 / C$	$(Anti\ X) = (m_o*c^2)^2 / C$	(166)

$$\sigma(X)^2 = \Delta(X)^2 / C^2 = (A^2 * B^2)/(C^4) = (X*(Anti\ X))/C^2 \qquad (167)$$

$$\sigma(X)^2 = X*(Anti\ X)/C^2 \qquad (168)$$

$$\sigma(X)^2 *C^2 = X*(Anti\ X) \qquad (169)$$

$$\sigma(X)^2 *C^2 = ((p_r*c)^2 / C)*(Anti\ X) \qquad (170)$$

$$\sigma(X)^2 *C^2 = ((p_r*c)^2 / C)*((m_o*c^2)^2 / C) \qquad (171)$$

$$\sigma(X)^2 *C^2*C^2 = (p_r*c)^2 *(m_o)^2*c^2 *c^2 \quad (172)$$

$$\sigma(X)^2 *C^2*C^2 = (p_r*c)^2 *(m_o)^2*c^2 *c^2 \quad (173)$$

$$\sigma(X)^2 *C^2*C^2 = ((v*m_o)/ (1- (v^2/c^2))^{1/2})*c)^2 *(m_o)^2*c^2 *c^2 \quad (174)$$

$$\sigma(X)^2 *C^2*C^2 = ((m_o)^2 * (m_o)^2 * (v^2* c^2 * c^2 *c^2)) / ((c^2- v^2)/c^2) \quad (175)$$

$$\sigma(X)^2 *C^2*C^2 = ((m_o)^2 * (m_o)^2 * (v^2* c^2 * c^2 *c^2 *c^2)) / (c^2- v^2) \quad (176)$$

$$\sigma(X)^2 *(c^2- v^2) * C^2*C^2 = ((m_o)^2 * (m_o)^2 * (v^2* c^2 * c^2 * c^2 *c^2)) \quad (177)$$

$$\sigma(X)^2 *(c^2- v^2) * ((m_o *c^2)/(1-(v^2/c^2))^{1/2})^2*C^2 = ((m_o)^2*(m_o)^2*(v^2*c^2*c^2*c^2*c^2)) \quad (178)$$

$$\sigma(X)^2 *(c^2- v^2) * (((m_o)^2*(c^2)^2)/(1-(v^2/c^2)))*C^2 = ((m_o)^2*(m_o)^2*(v^2*c^2*c^2*c^2*c^2)) \quad (179)$$

$$\sigma(X)^2 *(c^2- v^2) * (((m_o)^2*(c^2)^2)/((c^2-v^2)/c^2)))*C^2 = ((m_o)^2*(m_o)^2*(v^2*c^2*c^2*c^2*c^2)) \quad (180)$$

$$(\sigma(X)^2 *\mathbf{C^2}*(c^2- v^2)) /((c^2-v^2)/c^2) = ((m_o)^2*(v^2 * c^2*c^2)) \quad (181)$$

$$(\sigma(X)^2*c^2 *\mathbf{C^2}*(c^2- v^2)) /(c^2-v^2) = ((m_o)^2*(v^2 * c^2*c^2)) \quad (182)$$

$$(\sigma(X)^2*\mathbf{C^2}) = ((m_o)^2*(v^2 *c^2)) \quad (183)$$

$$(\sigma(X)^2* (m_o)^2* (c^2)^2) /(1-(v^2/c^2)) = ((m_o)^2*(v^2 *c^2)) \quad (184)$$

$$(\sigma(X)^2* (c^2)) /((c^2 - v^2)/c^2) = (v^2) \quad (185)$$

$$(\sigma(X)^2* (c^2)^2) /(c^2 - v^2) = (v^2) \quad (186)$$

$$(\sigma(X)^2* (c^2)^2) = (v^2)*(c^2 - v^2) \quad (187)$$

$$\sigma(X)^2 = (v^2 / c^2) * ((1 - (v^2 / c^2)) \quad (188)$$

Q. e. d.

Set v = c then $\sigma(X)^2 = (v^2 / c^2) * ((1 - (v^2 / c^2)) = 0$. The inner contradiction of the relativistic energy–momentum relation can be calculated as

$$\Delta(X)^2 = v^2 * ((c^2 - v^2) /c^2) = v^2 * \gamma^2 .$$

4. Discussion

A process in the Standard Model called charge-parity (CP) violation is claimed to be responsible for the difference between matter and antimatter in our universe. CP violation in the Standard Model can be explained to some extent in terms of a triangle. The amount of violation in this sense is proportional to the area of the triangle. The physicists need to calculate the area of such triangles to better test their model.

Triangles have to do more or less with the Pythagorean theorem. This publication has proofed that Pythagorean theorem is nothing special, the same is based on pure classical logic, especially on the law of the excluded middle and on the general contradiction law too. The new relationship found in this publication will help to analyse the most basic relationships in nature, especially the inner contradiction of a general right triangle. In so far, classical logic can must enter Standard model too.

On the other hand, if v reaches the speed of light or if v = c, we have the pure v, the v without its own other, a v without its own Anti v. In this case we obtain

$$\sigma(X)^2 = 0$$

according to Barukčić (Barukčić, 2006c). In this case, we obtain equally the inner contradiction of X as

$$\Delta(X)^2 = v^2 * ((c^2 - v^2) /c^2) = (v{=}c)^2 * (1- ((v{=}c)^2/c^2)) = 1^2 - (1-1^2) = 0.$$

In so far, as long as v < c, a local hidden variable (Einstein et. al., 1935) is active. If v reaches the speed of light or if v = c, we obtain according to the law of contradiction of classical logic

$$\Delta(X)^2 = X * \text{Not } X = 0.$$

According to Barukčić (Barukčić 2006a, p. 354) Einstein's relativistic correction and the (logical) negation are very familiar with each other and at the end identical to some extent.

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