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"Anti" CHSH inequality - natura facit saltus.

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Abstract

The relation between the hidden and non-hidden part of something is not without conflicts. The one is the hidden, the other the non-hidden, but equally both are only as separated in the same relation, each excludes thus the other from itself. The one is in relation with itself by its other and contains the same. It is thus the whole, self-contained opposition. The one is without its other, the hidden is not the non-hidden and vice versa, the hidden excludes from itself the non-hidden and thus at the end its own self, each side in its own self excludes itself. It is quite clear that both are opposed to each other. This lack can be taken as their determinateness. The one that has within itself the difference from itself changes under certain conditions. The quantitative alteration of something has a range within it remains indifferent to any alteration, it is indifferent towards the other of itself. Under this circumstances, the something does not change its quality at all. Only, there is always a point in this quantitative alteration of something at which the quality of that something is changed, the quantum shows itself as specifying, the point of no return is reached, natura facit saltus. The altered something converts itself into a new quality, into a negation of a negation, into a new something. The new something is subject of the same alteration and so on to infinity. This publication will proof, that

the CHSH inequality is not compatible with

Einstein's General Relativity and

Heisenberg's uncertainty principle.

Key words: Change, Natura facit saltus, CHSH inequality, Einstein, Heisenberg, General contradiction law, Barukčić.

1. Introduction

The CHSH inequality was derived by John Clauser, Michael Horne, Abner Shimony and Richard Holt in a very much-cited paper published in 1969 (Clauser, 1969)**.** The Clauser-Horne-Shimony-Holt (CHSH) inequality, an inequality of Bell's type, is as such related closely to Bell's theorem. Bell's (1964) theorem that bears his name is meanwhile proofed as a logical fallacy of the excluded middle (Barukčić 2006c, 2006d). Is the CHSH inequality besides of this still consistent with quantum mechanics and hidden-variable theory with its underlying determinism? To say that the CHSH inequality is correct is to say that the same is compatible with Einstein and Heisenberg. For our present purposes the important point to recognise, in particular, is that, is there a disagreement between the CHSH inequality and Einstein and Heisenberg? However, it seems reasonable to suppose that it is difficult to advocate the CHSH inequality if there is a disagreement between the same and Einstein and Heisenberg. The question naturally arises, how can we proof, is the CHSH inequality compatible with Einstein and Heisenberg?

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2. Methods

The CHSH inequality

The original 1969 derivation of the CHSH inequality is not that much easy to follow. The usual form of the Clauser-Horne-Shimony-Holt (CHSH) inequality is known to be:

$$\mathbf{-2} \leq \mathbf{(}\ E(a, b) - E(a, b') + E(a', b) + E(a' b')\ \mathbf{)} \leq \mathbf{+2}$$

or

$$\mathbf{-2} \leq \mathbf{S} \leq \mathbf{+2}$$

where

a	denote the detector settings on side A,
a'	denote the detector settings on side A,
b	denote the detector settings on side B,
b'	denote the detector settings on side B,
$E(a, b)$ etc.	denote the quantum correlations of the particle pairs,
S	denote $E(a, b) - E(a, b') + E(a', b) + E(a' b')$.

Once an experimental estimate of *S* is found it is claimed that a numerical value of S greater than 2 has infringed the CHSH inequality. Consequently, according to the CHSH inequality, the experiment is declared to rule out all local hidden variable theories and supports the quantum mechanics prediction.

3. Results

3.1. Chebyshev's inequality

Pafnuty Chebyshev (May 16, 1821 - December 8, 1894), a Russian mathematician, was born as a son of a wealthy landowner in the village of Okatovo, a small town in western Russia, west of Moscow. Chebyshev is known for his work about the Chebyshev's inequality too.

Let

X	denote a random variable X,
E(X)	denote the expectation value of a random variable X,
a	denote any real number, where **a > 1**,
σ(X)	denote the standard deviation of the random variable X,
$p(\mid X - E(X) \mid \geq a^*\sigma(X))$	denote the probability that the outcome of a random variable with standard deviation σ(X) is no less than $a^*\sigma$(X) away from its expectation value, then the Chebyshev's inequality is known to be

$$\mathbf{p(\mid X - E(X) \mid \geq a^*\sigma(X)) \leq (1 / (a^*a)).}$$

The Chebyshev inequality above can be used to proof the relationship between the hidden and non-hidden part (Barukčić 2006c) of something, f. e. of a measurable random variable.

Let

X_t denote something existing independently of human mind and consciousness, f. e. a measurable random variable, a quantum mechanics object etc. at the (space) time t,

h_t denote the **hidden** (dark or secret) **part (variable)** of something existing independently of human mind and consciousness**,** f. e. of a random variable or of a quantum mechanics object X_t etc. at the (space) time t, the hidden part of X_t,

$(\text{not } h)_t$ denote the **not-hidden part (variable)** of something existing independently of human mind and consciousness**,** f. e. of a random variable or of a quantum mechanics object X_t etc. at the (space) time t, the not-hidden of X_t, there is no third between $(h)_t$ and $(\text{not } h)_t$,

$(h)_t + (\text{not } h)_t = X_t$ denote that something that is existing independently of human mind and consciousness, f. e. a measurable random variable, a quantum mechanics object etc. at the (space) time t is determined by a hidden and a non-hidden part (variable), there is no third between the hidden and a non-hidden part, **tertium non datur**,

$E(X_t)$ denote the expectation value of something existing independently of human mind and consciousness, f. e. a measurable random variable, a quantum mechanics object etc. at the (space) time t,

$\sigma(X_t)^2$ denote the variance of something existing independently of human mind and consciousness, f. e. a measurable random variable, a quantum mechanics object etc. at the (space) time t,

a denote any real number, where **a > 1**,

t denote the (space) time,

$p(| X_t - E(X_t) | \geq a*\sigma(X_t))$ denote the probability that the outcome of a random variable with standard deviation $\sigma(X_t)$ is no less than $a*\sigma(X_t)$ away from its expectation value,

then

$$\mathbf{-2 \leq \quad | \; 2*(a*a)*p(| X_t - E(X_t) | \geq a*\sigma(X_t)) \; | \quad \leq +2.}$$

Proof.

$$p(| X_t - E(X_t) | \geq a*\sigma(X_t)) \leq (1 / (a*a)) \tag{1}$$

$$p(| (\mathbf{h_t + (not\ h)_t}) - E(X_t) | \geq a*\sigma(X_t)) \leq (1 / (a*a)) \tag{2}$$

Our assumption is that **there are no hidden variables**, we set $\mathbf{h_t = 0}$. Thus, we obtain

$$p(| ((\mathbf{h_t = 0}) + (\text{not } h)_t) - E(X_t) | \geq a*\sigma(X_t)) \leq (1 / (a*a)) \tag{3}$$

$$p(| ((\mathbf{0}) + (\text{not } h)_t) - E(X_t) | \geq a*\sigma(X_t)) \leq (1 / (a*a)) \tag{4}$$

$$p(| (\text{not } h)_t - E(X_t) | \geq a*\sigma(X_t)) \leq (1 / (a*a)) \tag{5}$$

Our assumption is that there are no hidden variables. In so far, we obtained an **identity** of the random variable $\mathbf{X_t}$ itself and **(not h)$_\mathbf{t}$** , both are the same. In other words, the not hidden or measured part of $\mathbf{X_t}$ is the whole $\mathbf{X_t}$ itself, there is nothing else, **no hidden** part. We cannot distinguish between **(not h)$_\mathbf{t}$** and $\mathbf{X_t}$ both are identical and are the same. In so far, we obtain

$$p(\mid (X_t =(\text{not } h)_t) - E(X_t) \mid \geq a*\sigma(X_t)) \leq (1 / (a*a)) \tag{6}$$

$$p(\mid (X_t = X_t) - E(X_t) \mid \geq a*\sigma(X_t)) \leq (1 / (a*a)) \tag{7}$$

$$\mathbf{p(\mid X_t - E(X_t) \mid \geq a*\sigma(X_t)) \leq (1 / (a*a))} \tag{8}$$

In so far, Chebyshev's inequality can be used for our purposes because the same is able to say something about hidden local variables.

$$(a*a) * p(\mid X_t - E(X_t) \mid \geq a*\sigma(X_t)) \leq 1 \tag{9}$$

$$2 * (a*a) * p(\mid X_t - E(X_t) \mid \geq a*\sigma(X_t)) \leq +2 \tag{10}$$

Eq. (10) times (-1) yields Eq. (11).

$$- (2 * (a*a) * p(\mid X_t - E(X_t) \mid \geq a*\sigma(X_t))) \geq -2 \tag{11}$$

In general, we obtain the Eq. (12).

$$\mathbf{-2 \leq \mid (2 * (a*a) * p(\mid X_t - E(X_t) \mid \geq a*\sigma(X_t))) \mid \leq +2} \tag{12}$$

Q. e. d.

The Chebyshev's inequality is proofed and known as correct. If the CHSH inequality is true, correct and valid, then there should not be a contradiction between

$$\mathbf{-2} \leq \mathbf{(} E(a, b) – E(a, b') + E(a', b) + E(a' b') \mathbf{)} \leq \mathbf{+2}$$

and

$$-2 \leq \mid (2 * (a*a) * p(\mid X_t - E(X_t) \mid \geq a*\sigma(X_t))) \mid \leq +2.$$

However, it seems reasonable to suppose that there will be a contradiction. Consequently, in this case, it would be difficult to advocate the CHSH inequality further. According to Chebyshev's inequality it is

$$\mathbf{p(\mid X_t - E(X_t) \mid \geq 2*\sigma(X_t)) \leq (1 / 4).}$$

In so far, $2*\sigma(X_t)$ seems to be the point of no return in nature, the point where hidden changes into non-hidden, where matter changes into antimatter, where healthy becomes ill and vice versa.

3.2. Heisenberg's uncertainty principle

Heisenberg uncertainty principle or the Heisenberg indeterminacy principle (Niels Bohr) was discovered by Werner Heisenberg in 1927 and states in general that increasing the accuracy of the measurement of one quantity (**non - hidden** part of a random variable) increases the uncertainty of the simultaneous measurement of its other quantity, its complement, its negation (the **hidden part** of the same random variable). Let us assume, that Heisenberg uncertainty relations provides a quantitative relationship between the uncertainties of the hidden and non-hidden part of the same random variable. One fundamental consequence of the Heisenberg Uncertainty Principle is thus that it can be used to proof whether the CHSH inequality is correct.

Let

X_t	denote something existing independently of human mind and consciousness, f. e. a measurable random variable, a quantum mechanics object etc. at the (space) time t,
h_t	denote the **hidden** (dark or secret) **part (variable)** of something existing independently of human mind and consciousness, f. e. of a random variable or of a quantum mechanics object X_t etc. at the (space) time t, the hidden part of X_t,
$(\text{not } h)_t$	denote the **not-hidden part (variable)** of something existing independently of human mind and consciousness, f. e. of a random variable or of a quantum mechanics object X_t etc. at the (space) time t, the not-hidden of X_t, there is no third between $(h)_t$ and $(\text{not } h)_t$,
$(h)_t + (\text{not } h)_t = X_t$	denote that something that is existing independently of human mind and consciousness, f. e. a measurable random variable, a quantum mechanics object etc. at the (space) time t is determined by a hidden and a non-hidden part (variable), there is no third between the hidden and a non-hidden part, **tertium non datur**. Let us assume that $(h)_t \leq (\text{not } h)_t$,
$E(X_t)$	denote the expectation value of something existing independently of human mind and consciousness, f. e. a measurable random variable, a quantum mechanics object etc. at the (space) time t,
$\sigma(X_t)^2$	denote the variance of something existing independently of human mind and consciousness, f. e. a measurable random variable, a quantum mechanics object etc. at the (space) time t,
$\sigma((h)_t)^2$	denote the variance of something existing independently of human mind and consciousness, f. e. the uncertainty of the simultaneous measurement of $(h)_t$ at the (space) time t,
$\sigma((\text{not } h)_t)^2$	denote the variance of something existing independently of human mind and consciousness, f. e. the uncertainty of the simultaneous measurement of $(\text{not } h)_t$ at the (space) time t,
$\sigma((\text{not } h)_t, (h)_t)$	denote the co-variance of $(h)_t$ and $(\text{not } h)_t$ at the (space) time t,
h	denote Planck's constant, $h \approx$ **(6.626 0693 (11)) * 10^{-34} [J * s],**
$\hbar = h/(2 * \pi)$	denote **Dirac's constant,** the reduced Planck constant, pronounced "h-bar",
π	denote the mathematical constant π, also known as **Archimedes' constant.** The numerical value of π truncated to 50 decimal places is known to be about **$\pi \approx$ 3.14159 26535 89793 23846 26433 83279 50288 41971 69399 37510,**
t	denote the (space) time,

then

$$-2 \leq \left| \left(2 * \sigma((\text{not } h)_t, (h)_t) / (\sigma((\text{not } h)_t) * \sigma((h)_t)) \right) \right| \leq +2$$

Proof.

$$\mathbf{(h)_t \le (not\ h)_t} \quad (13)$$

$$((h)_t)^2 \le ((not\ h)_t)^2 \quad (14)$$

$$E((h)_t) \le E((not\ h)_t) \quad (15)$$

$$E((h)_t)^2 \le E((not\ h)_t)^2 \quad (16)$$

$$E(((h)_t)^2) \le E(((not\ h)_t)^2) \quad (17)$$

$$E(((h)_t)^2) - E((h)_t)^2 \le E(((not\ h)_t)^2) - E((h)_t)^2 \quad (18)$$

According to Eq. (16) we substitute $E((h)_t)^2$ by $E((not\ h)_t)^2$.

$$E(((h)_t)^2) - E((h)_t)^2 \le E(((not\ h)_t)^2) - E((not\ h)_t)^2 \quad (19)$$

$$\sigma((h)_t)^2 \le \sigma((not\ h)_t)^2 \quad (20)$$

Recall that $\sigma((h)_t) \ge 0$ or $\sigma((not\ h)_t) \ge 0$.

$$\sigma((h)_t) \le \sigma((not\ h)_t) \quad (21)$$

According to Eq. (19), (20) and (21) we obtain Eq. (22).

$$E(((h)_t)^2) - E((h)_t)^2 \le \sigma((not\ h)_t) * \sigma((not\ h)_t) \quad (22)$$

According to Eq. (21) it is $\sigma((h)_t) \le \sigma((not\ h)_t)$. We obtain Eq. (23).

$$E(((h)_t)^2) - E((h)_t)^2 \le \sigma((h)_t) * \sigma((not\ h)_t) \quad (23)$$

$$E((h)_t - E(h)_t)^2 \le \sigma((h)_t) * \sigma((not\ h)_t) \quad (24)$$

$$E((h)_t - E(h)_t)* ((h)_t - E(h)_t) \le \sigma((h)_t) * \sigma((not\ h)_t) \quad (25)$$

We use Eq. (13) and Eq. (15) and obtain Eq. (26).

$$E((h)_t - E(h)_t)* ((not\ h)_t - E(not\ h)_t) \le \sigma((h)_t) * \sigma((not\ h)_t) \quad (26)$$

On the left side of the Eq. (26) we obtained the covariance.

$$\sigma((h)_t , (\text{not } h)_t) \le \sigma((h)_t) * \sigma((\text{not } h)_t) \tag{27}$$

Set $\sigma((h)_t) > 0$ or $\sigma((\text{not } h)_t) > 0$.

$$(\sigma((h)_t , (\text{not } h)_t) / (\sigma((h)_t) * \sigma((\text{not } h)_t))) \le +1 \tag{28}$$

$$2 * (\sigma((h)_t , (\text{not } h)_t) / (\sigma((h)_t) * \sigma((\text{not } h)_t))) \le +2 \tag{29}$$

Eq. (28) time (-1) yields Eq. (29).

$$-2 * (\sigma((h)_t , (\text{not } h)_t) / (\sigma((h)_t) * \sigma((\text{not } h)_t))) \ge -2 \tag{30}$$

$$-2 \le | 2 * (\sigma((h)_t , (\text{not } h)_t) / (\sigma((h)_t) * \sigma((\text{not } h)_t))) | \le +2 \tag{31}$$

Q. e. d.

According to Barukčić (Barukčić 2006c, pp. 15-16), we know that $\sigma((h)_t , (\text{not } h)_t) = 0$ if $(h)_t$ has nothing to do with $(\text{not } h)_t$, if both are absolutely independent from each other, each outside the sphere of its other. In this case we obtain

$$-2 \le | 2 * (0 / (\sigma((h)_t) * \sigma((\text{not } h)_t))) | \le +2.$$

Heisenberg uncertainty relations is known to be $(\sigma((h)_t) * \sigma((\text{not } h)_t)) \ge (h/(4*\pi))$. In so far if there is a relation between a hidden and non-hidden part of the same random variable then it has to be at least that $| \sigma((h)_t , (\text{not } h)_t) | > 0$. On the other hand, if relation between a hidden and non-hidden part of the same random variable is constituted by Heisenberg's uncertainty relation then equally is must be true that

$$-2 \le | 2 * (h / (4*\pi* \sigma((h)_t) * \sigma((\text{not } h)_t))) | \le +2$$

or

$$-2*\sigma((\text{not } h)_t) \le | 2 * (h / (4*\pi* \sigma((h)_t))) | \le +\mathbf{2}*\sigma((\text{not } h)_t) \tag{32}$$

or

$$-2*\sigma((\text{not } h)_t) \le | (h / (2 *\pi* \sigma((h)_t))) | \le +\mathbf{2}*\sigma((\text{not } h)_t)$$

Dirac's constant is known to be $\hbar = h/(2*\pi)$. Thus we obtain

$$-2*\sigma((\text{not } h)_t) \le | (\hbar / \sigma((h)_t) | \le +\mathbf{2}*\sigma((\text{not } h)_t).$$

Why should the CHSH inequality be not compatible with the equations derived on this page f. e. like

$$-2 \le | (\hbar / (\sigma((h)_t) *\sigma((\text{not } h)_t)) | \le +\mathbf{2}. \tag{33}$$

3.3. Unified field equation

The unified field equation cannot be free of the relation between the hidden local variable and non-hidden local variable of something.

Unified field equation and hidden and non-hidden variable.

Let

R_{ab} denote the Ricci tensor,

R denote the Ricci scalar,

g_{ab} denote the metric tensor,

T_{ab} denote the stress-energy tensor,

h denote Planck's constant, **h ≈ (6.626 0693 (11)) * 10^{-34} [J * s],**

π denote the mathematical constant π, also known as **Archimedes' constant.** The numerical value of π truncated to 50 decimal places is known to be about

π ≈ 3.14159 26535 89793 23846 26433 83279 50288 41971 69399 37510,

c denote the speed of all electromagnetic radiation in a vacuum, the speed of light, where

***c* = 299 792 458 [m / s],**

γ denote Newton's gravitational 'constant', where

γ ≈ (6.6742 ± 0.0010) * 10^{-11} [m^3 / (s² * kg)],

Einstein's field equation describes how a field or energy (or matter) and time changes space and vice versa. Einstein's basic field equation (EFE) is usually written in the form

$$(((4 * 2 * \pi * \gamma) * T_{ab}) / (c^4)) + ((R * g_{ab}) / 2)) = (R_{ab}).$$

The unified field equation is derived (Barukčić 2006f) as

$$(((4 * 2 * \pi * \gamma) * T_{ab}) / (c^4)) * ((R * g_{ab}) / 2)) \leq ((R_{ab}) * (R_{ab}))/ 4.$$

then

$$-2 \leq | (2*4*(((4*2*\pi*\gamma)*T_{ab})/(c^4))*((R*g_{ab})/2))/ ((R_{ab})* (R_{ab})) | \leq +2$$

Proof. Eq.

$$((((4*2*\pi*\gamma)*T_{ab})/(c^4))*((R*g_{ab})/2))) \leq ((R_{ab})* (R_{ab}))/ 4 \tag{34}$$

Let us assume that a division by $((R_{ab})* (R_{ab}))$ is allowed.

If the division by $((R_{ab})* (R_{ab}))$ is not allowed, we set $((R_{ab})* (R_{ab})) = 1$.

$$4*((((4*2*\pi*\gamma)*T_{ab})/(c^4))*((R*g_{ab})/2)))/ ((R_{ab})* (R_{ab})) \leq +1 \tag{35}$$

$$(2 *4*((((4*2*\pi*\gamma)*T_{ab})/(c^4))*((R*g_{ab})/2)))/ ((R_{ab})* (R_{ab}))) \leq +2 \tag{36}$$

Eq. (36) times (-1) yields Eq. (37).

$$- (2 *4*((((4*2*\pi*\gamma)*T_{ab})/(c^{4}))*((R*g_{ab})/2)))/ ((R_{ab})* (R_{ab}))) \geq -2 \quad (37)$$

At the end we obtain Eq. (38).

$$-2 \leq | (2 *4*((((4*2*\pi*\gamma)*T_{ab})/(c^{4}))*((R*g_{ab})/2)))/ ((R_{ab})* (R_{ab}))) | \leq +2 \quad (38)$$

Q. e. d.

Why should the CHSH inequality be not compatible with Einstein's field equation and the unified field equation? This is a very precise inequality. If there is a problem between locality in General Relativity and in Quantum Mechanics, then this inequality must be violated.

3.4. Natura facit saltus in general

The quantitative alteration of X_t and Anti X_t is not at the same time identical with the creation of a new something, a new quality. The quantitative alteration of X_t and Anti X_t remains to some extent indifferent to this quantitative alteration. The relationship between X_t and Anti X_t is determined by the fact, that there is a point, where this quantitative alteration of both shows itself as specifying, **natura facit saltus**, something new is created, the altered X_t and Anti X_t are converted into a new something. The transition of X_t and Anti X_t into something new is a leap. In this new, the difference of X_t and Anti X_t has found its own completion (Hegel 1988, p. 424). If there is something like a hidden local variable and a non-hidden local variable of the same something then there must be a relation to the general contradiction law (Barukčić, 2006e) too.

Natura facit saltus in general.

Let

X_t denote non-hidden part of something existing independently of human mind and consciousness, f. e. of a measurable random variable, of a quantum mechanics object, σ(..) etc. at the (space) time t,
X_t be opposed to (Anti X)$_t$,

Anti X_t denote the other side of X_t, the opposite of X_t, the complementary of X_t, the hidden part of X_t , a random variable, at the (space) time t,
Anti X_t be opposed to X_t,

t denote the (space) time t,

C_t denote the unity of X_t and (Anti X)$_t$,
us respect **the law of the excluded middle**. That is to say, there is no third between X_t and Anti X_t at the same (space) time t. In so far, we obtain equally

$$\mathbf{X_t + (Anti\ X)_t = C_t ,}$$

$$\text{or } (Anti\ X)_t = C_t - X_t.$$

Further, the general contradiction law is known to be

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

Then

$$\mathbf{-2 \leq | (2*4*(X_t * (Anti\ X)_t) / C_t^2) | \leq +2.}$$

Proof.

$$\mathbf{X_t * (Anti\ \ X)_t \quad \leq \quad C_t{}^2 / 4} \tag{39}$$

Let us assume, that a division by $C_t{}^2$ is allowed and possible.

$$4*(X_t * (\text{Anti}\ \ X)_t)/ C_t{}^2 \ \leq\ 1 \tag{40}$$

$$((2*4*(X_t * (\text{Anti}\ \ X)_t))\ / C_t{}^2)\ \leq\ +2 \tag{41}$$

$$- ((2*4*(X_t * (\text{Anti}\ \ X)_t))\ / C_t{}^2) \geq\ -2 \tag{42}$$

$$\mathbf{-2\ \leq\ |\ ((2*4*(X_t * (Anti\ \ X)_t))\ / C_t{}^2)\ |\ \leq\ +2} \tag{43}$$

Q. e. d.

Why should the CHSH inequality be not compatible with the inequality (43) derived from the general contradiction law?

4. Discussion

This publication has shown that the CHSH inequality has been given at least a very imprecise definition of the relation between the hidden and non-hidden part of something. In other words, the CHSH inequality is not deeply connected with Einstein's and Heisenberg's understanding of the physical sciences. Roughly speaking, the explanatory ambitions of the CHSH inequality are more or less not based on basic and secured scientific findings.

Experiments based on the inequalities derived and proofed in this publication should be able to proof the opposite of the CHSH inequality.

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References

Barukčić, Ilija. (1989). Kausalität. First Edition. Wissenschaftsverlag, Hamburg.
Barukčić, Ilija. (2006a). Causality. New Statistical Methods. Second Edition. Books on Demand, Hamburg. pp. 488.
Barukčić, Ilija. (2006b). New Method For Calculating Causal Relationships, Montréal: XXIII International Biometric Conference, July 16 - 21 2006.
Barukčić, Ilija (2006c). "Local hidden variable theorem, " *Causation* **1,** 11-17.
Barukčić, Ilija (2006d). "Bell's Theorem - A fallacy of the excluded middle," *Causation* **2,** 5-26.
Barukčić, Ilija (2006e). "General contradiction law," *Causation* **3,** 5-26.
Barukčić, Ilija (2006f). "Unified field equation," *Causation* **4,** 5-19.
Bell, J.S. (1964). "On the Einstein-Podolsky-Rosen paradox," *Physics* **1**, 195-200.
Bell, J.S. (1966). "On the problem of hidden variables in quantum mechanics," *Reviews of Modern Physics* **38**, 447-452.
Bohm, D. (1952), "A suggested interpretation of the quantum theory in terms of 'hidden' variables," I. *Physical Review* **85**, 166-179; II. *Physical Review* **85**, 180-193.
Clauser, J. F. and Horne, M.A. and Shimony, A. and R. A. Holt. (1969). "Proposed experiment to test local hidden-variable theories," *Phys. Rev. Lett.* **23**, 880-884.
Einstein, Albert. (1905). "Zur Elektrodynamik bewegter Körper," *Annalen der Physik* Bd. XVII, p. 891-921.
Einstein, Albert. (1916). "Die Grundlage der allgemeinen Relativitätstheorie," *Annalen der Physik*, Vierte Folge, Vol. 49, **7**, 769 - 822.
Einstein, Albert. (1908). "Über das Relativitätspnnzip und die aus demselben gezogenen Folgerungen," *Jahrbuch der Radioaktivität und Elektronik* **4**, 411-462.
Einstein, Albert. (1908). "Berichtigungen zu der Arbeit: Über das Relativitätspnnzip und die aus demselben gezogenen Folgerungen," *Jahrbuch der Radioaktivität und Elektronik* **5**, 98-99.
Einstein, A., Podolsky, B., and Rosen, N. (1935), "Can quantum-mechanical description of physical reality be considered complete?" *Physical Review* **47**, 770-780.
Heisenberg, W. (1927). "Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik," *Zeitschrift für Physik* **43**, 172-198.
Hegel, G. W. H. *Hegel's science of logic*, Edited by H. D. Lewis, Translated by A. V. Miller (New York: Humanity Books, 1998), pp. 844.

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