

**THEORY OF SPECIAL QUANTUM RELATIVITY**

MANOEL ENÉAS BARRETO  
UNIVERSITY OF BRASILIA - UNB  
E-MAIL: BARRETOEM@IBEST.COM.BR

ABSTRACT. This article highlights some important points of another article “Would  $\epsilon = h\nu = \frac{m_0 v^2}{\sqrt{1-(\frac{v}{c})^2}}$ ?”, and draws the attention of researchers for the need to try to perform experimental investigations to measure the speed associated with electromagnetic waves whose frequencies are close to 10.000 Hz.

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1. VARIABLE SPEED OF LIGHT (VSL)

We have recently made an article available on this website, “Would  $\epsilon = h\nu = \frac{m_0 v^2}{\sqrt{1-(\frac{v}{c})^2}}$ ?”, which poses, among other question, the following possibility: *Given two wave lengths,  $\lambda_1 \neq \lambda_2$ , and, therefore,  $\nu_1 \neq \nu_2$ , we have, obligatorily,  $v_1 \neq v_2$* , as shown in columns 4, 5 e 3, respectively, on the following table<sup>1</sup>:

1	2	3	4	5	6
$\underbrace{x}_{km}$	$\underbrace{1/t}_{Hz}$	$\underbrace{v}_{km/s}$	$\lambda = \underbrace{x \sqrt{1 - (\frac{v}{c})^2}}_{km}$	$\nu = \underbrace{\frac{1}{t \sqrt{1 - (\frac{v}{c})^2}}}_{Hz}$	$c - v$
0	1	0	0	1	299.792,4586 km/s
...	...	...	...	...	...
299.790	1	299.790	1.214,1290...	246,9177...	2.458,6 m/s
299.791	1	299.791	935,1705...	320,5736...	1.458,6 m/s
299.792	1	299.792	524,3744...	571,7135...	458,6 m/s
299.792,27	1	299.792,27	336,2759...	891,5066...	188,6 m/s
299.792,4	1	299.792,4	187,4450...	1.599,3612...	58,6 m/s
299.792,45	1	299.792,45	71,8082...	4.174,9005...	8,6 m/s
<b>299.792,4571...</b>	<b>1</b>	<b>299.792,4571...</b>	<b>29,979245...</b>	<b>10.000</b>	<b>1,5 m/s</b>
299.792,458	1	299.792,458	18,9671...	15.805,9181...	0,6 m/s
299.792,4581	1	299.792,4581	17,3145...	17.314,5158...	0,5 m/s
299.792,4582	1	299.792,4582	15,4865...	19.358,2172...	0,4 m/s
299.792,4583	1	299.792,4583	13,4117...	22.352,9438...	0,3 m/s
...	...	...	...	...	...
299.792,4586	1	299.792,4586	0	$\infty$	$0 \times 10^0 \text{ \AA/s}$

TABLE 1. Electromagnetic Spectrum Fragment

<sup>1</sup>See item “2.4. Point of Falsification”, of the article in question.

As an example, for waves with frequencies of 10.000 Hz, the theoretical prediction is that the electromagnetic field would reach a speed of 299.792,4571... km/s, *that is 1,5 m/s slower than the propagation of an electromagnetic field associated with the chosen referential limit, whose speed is 299.792,4586 km/s<sup>2</sup>.*

This prediction is found, in conjunctural form, on the doctoral dissertation “Recherches Sur La Théorie De Quanta”, defended in 1924 by Louis De Broglie, and translated by A. F. Kracklauer in 2004 as “On the Theory of Quanta”, p. 41: “...one might hope that some day experiments on very long wave length light will reveal evidence of velocity discernibly below  $c$ . (De Broglie, 1925a, p. 60)”.

*Evidently that, if confirmed, this numerical data could break the second postulate<sup>3</sup> of the Special Theory of Relativity, suggesting for that matter, that it should be revised<sup>4</sup>.*

As an immediate consequence, we would lose the condition to make comparisons of the  $v/c$  type, as well as to determine the state of movement of any kind of physical matter, arriving at the conclusion that *if there is such a profound “reality”, there are no means to determine it<sup>5</sup>.*

## 2. QUANTIFICATION OF PHYSICAL PHENOMENA

On the other hand, according to the theoretical model proposed in the referred article, we can also infer that the hypothesis contained in Item 10<sup>6</sup> of the article “On the Law Distribution of Energy In The Normal Spectrum” by Max Planck, can be substituted by

$$\epsilon = m_0 v^2 t \cdot \frac{1}{t \sqrt{1 - (\frac{v}{c})^2}}$$

with the “action constant”<sup>7</sup>,  $h = m_0 v^2 t$ , and the frequency<sup>8</sup>,  $\nu = \frac{1}{t \sqrt{1 - (\frac{v}{c})^2}}$ .

It is evident that, considering the context of the experience relative to the radiation of “black matter”,  $m_0$  is the photon’s “resting” mass,  $v$  is the approximate speed of these particles (which

<sup>2</sup>The value chosen to calculate the numerical values was of 299.792,4586 km/s, with an uncertainty of 0,0003 km/s more or less, that is, approximately 30 cm/s, obtained in 1983, by the U. S. Bureau of National Standards as a measurement of the speed of light using lasers.

<sup>3</sup>Also called “constancy of speed of light”.

<sup>4</sup>See Item “4.1. Theory of Special Quantum Relativity”, of the referred article.

<sup>5</sup>See Item “3.9. Indetermination”, of the referred article.

<sup>6</sup>According to this item “if we apply Wien’s Displacement Law, on its last form, the expression 6 of entropy  $S$ , we will understand that the element of energy  $\epsilon$  must be proportional to the number of oscillations  $\nu$ , and therefore,  $\epsilon = h\nu$ ”.

<sup>7</sup>The quantification, according to the “old Quantum Theory”, arrives naturally from this expression, as if we consider time  $t = 1$  second, when velocity,  $v \rightarrow c$  (reference limit chosen),  $h \rightarrow m_0 c^2$ , that is, pending to a value limit.

On the other hand, we can observe that this expression is compatible with the results expected from “classical arguments”, which take Rayleigh-Jeans equation the time  $t = 1$  second, when  $v \rightarrow c$ ,  $h \rightarrow 0$ .

We should also comment on the fact that the action constant,  $h$ , is valid only within the context of experiments in which it was produced, that is, the radiation of black matter. Therefore, its validity is restricted to calculations in which the particle involved is the Photon. Note that the equation  $h = m_0 v^2 t$ , associated, for example, to electrons, has another value, since the resting mass associated with the electron,  $(m_0)_e$ , is different than the resting mass associated with the photon,  $(m_0)_f$ . For different particles, we will have different values associated to the action constant,  $h$ . Observe further, that to determine particle, the so called action constant is a variable.

<sup>8</sup>On the referred article, the condition “if and only if  $\nu_c = \infty$ , where  $v < c$  and  $c$  is the referential limit”, was imposed to the equation.”

despite of being different are very close to one another)<sup>9</sup>, and time,  $t$ , is equal to 1 second<sup>10</sup>, according to the following calculation:

$$h \cong m_0 v^2 t = 7,28 \cdot 10^{-48} g \cdot (29.979.245.860)^2 \left(\frac{cm}{s}\right)^2 \cdot 1 s = 6,5339 \cdot 10^{-27} erg \cdot s^{11}.$$

*In this case scenario, the revolutionary hypothesis of the article “On the Law Distribution of Energy In The Normal Spectrum” by Max Planck,  $\epsilon = h\nu$ , would have a relativist origin, and, in a last instance, so would have the Quantum Theory.*

Thus, we pose the question: Is the opposition of view points about the Special Theory of Relativity and the Quantum Theory real, or does it derive from our inability to synthesize it?<sup>12</sup>

To make it applicable to quantic phenomena, the revision of the Special Theory of Relativity would have to rely, primarily, on experimental results that could demonstrate that the “constant speed of light” postulate (*although workable from a mathematical viewpoint*) is not valid, and thus, *that the theory itself is only “partially” valid*. I therefore request that researchers’ direct their attention to the pursuance of experimental verifications that measure the speed associated with electromagnetic waves with frequencies close to 10.000 Hz, to either validate or refute the constant proposal on “Table 1. Electromagnetic Spectrum Fragment”, column  $c - v$  of this article.

Translated to English by Luiz Lobo  
E-mail: lobotv@me.com

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<sup>9</sup>Utilizing equation 15 of the referred article,  $\lambda = x \sqrt{1 - (\frac{v}{c})^2}$ , one is able to calculate the speeds associated with wavelengths,  $\lambda$ , constants on the graphic which describes the experimental curve obtained for black matter radiation, and to verify that, although different, they are very close to one another.

<sup>10</sup>Observe that the speed,  $c$ , is equal to 299.792,4586 km in 1 second.

<sup>11</sup>The “rest” mass is on article “Photon: zero “rest” mass?”, while the discussion on possible speed differences associated to photons, are on item “3.7. Variable Speed of Light (VLS)”, of the referred article.

<sup>12</sup>The question is an adaptation of a phrase from “On Theory of Quanta”, De Broglie, 1925a, p. 33, according to the citation made by Pedro Sérgio Rosa, on his thesis “Louis De Broglie and Matter Waves”, p. 136.