

# Physics since Einstein

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*Abstract*

*Each scientist in physics has the moral responsibility to try to adapt mathematics to physics. Einstein adapted physics to his mathematics in his Special Theory of Relativity, with which the decay of physics began.*

# Prologue

## Common Sense Defies Modern Physics

*All my theoretical research on physics, created by and since Einstein, have led me to the belief that the higher the level of intelligence of the physicist, the more that can be a threat to the health of physical sciences. Einstein started the decline of this science with his Special Theory of Relativity!*

In 1905 Einstein introduced his Special Theory of Relativity (STR). The rumours I heard when I was about 16 years old were that only a few other extremely intelligent scientists would be able to understand this theory. A turning point in the history of physics, not only because of this supposed sublime theory, but even more because of the abandonment of the phenomenon 'ether'. Until that turning point no physicist ever thought about the possibility that this phenomenon would not be a realistic one. But the experiment of Michelson and Morley forced them to reject the ether, especially after Einstein came with his theory in which he did so.

After having successfully completed my academic study Electronics I decided, challenged by the above mentioned qualification of Einstein's theory, to investigate the STR. Having studied the first 10 pages for the umpteenth time my dilemma was: or I have to admit that only extremely intelligent scientists can understand this theory, or the theory is possibly wrong. I decided to investigate that possibility. The result of that investigation is shown in my first chapter: "Einstein's and Galilei's Principle of Relativity".

A few decades after the STR was published the genie was out of the bottle. Supported by the General Theory of Relativity too, nothing in physics was impossible anymore: light has the magic property of being  $c$  relative to whatever reference: the most unphysical, to express it mildly, hypothesis ever created in physics, mass can be generated by an arbitrary energy just by dividing it by  $c^2$ , time dilation has been used to create space-time, space-time causes black holes, matter and gravitational waves got accepted as realistic physical phenomena, muons got equipped with their own clock in order to adapt their decay time to their velocity, electrons got spinning by creating fundamentally wrong evidence, the particle-wave duality effectively got accepted as a formal theory, leading to the most unrealistic physical models, etc., etc. Especially the particle-wave duality did attract my attention resulting in a theory, shown in: "Why a photon is not a particle". This theory perfectly describes, based on Bohr's atomic model and generally accepted physical laws and constants for centuries, why a photon is no more and no less than an electromagnetic pulse with a very short duration.

During the development of this theory it turned out that the potential energy is wrongly, and above all with the wrong sign, included in Bohr's atomic model. The influence of that supposed, blatantly incorrect, property of orbiting electrons is dramatic: the atomic lowest energy state is supposed to perform when electrons orbit at the smallest distance to the nucleus! In reality, the opposite is true. As a result, Bohr's atomic model has turned into Heisenberg-Schrödinger's atomic model, full of vague phenomena.

While writing the article "Why Heisenberg-Schrödinger's Atomic Model is Invalid" all of a sudden my eye caught consciously a drawing of the nucleus of a Helium atom. I did accept for decades of years unconsciously this model as a realistic model, but now realized immediately that it is a most unrealistic one, being extremely "explosive" given the repulsive forces between the protons. But the scientific establishment found a solution for that problem: 'strong forces', brought on stage totally unfounded, hold them together. It looks like this imaginative solution has been camouflaged by the following even more imaginative approach.

Protons as well as neutrons are supposed to be composed of the exotic particles called up and down quarks. 'Up quarks' are supposed to be electric charged as  $+\frac{2}{3}e$ , 'down quarks' as  $-\frac{1}{3}e$ . Two 'up quarks' and one 'down quark' in a proton to obtain the electric charge  $1e$  and one 'up quark' and two 'down quarks' in a neutron to obtain zero electric charge. Extremely resourceful, but one wonders what the purpose of this fantasy might be. It makes the existing problem even more complex: alike charged quarks will repulse each other and unlike charged quarks will merge together.

But again the fantasy of this establishment is large: gluons have been introduced in order to 'glue' the alike quarks together (at a certain distance), while that same magic glue is also able to prevent unlike charged quarks to get merged. What happens here shows remarkable resemblance with what happened when mankind didn't, and still doesn't, understand how nature on earth and mankind itself originated: it created a 'strong force' that is supposed to do so and called it God. This religion like modelling of the atomic nuclei has led to the article: "Atomic Nuclei Modelled Without Exotic Particles and Magic Forces".

Many articles, accepted by the scientific establishment, give the impression that not physics has been tried to model, but that mathematics, applied by the members of this establishment, determines how physics behaves. Physicists even created 'mathematical physics', in order to "develop mathematical methods for application to problems in physics." Seemingly physics has been replaced by mathematics.

N.B. The craziest 'physics' can be created with mathematics. A perfect example is: Emergent Gravity and the Dark Universe, by Erik Verlinde.

The scientific establishment is organized in such a way that only ideas sprouted from the brains of the members of this establishment are accepted for publishing in magazines created by this establishment itself. The butcher approves his own meat.

I have to admit that many physicists who are not a member of this 'club' have generated thousands of the craziest ideas too. Why not? The scientific establishment presents an enormous amount of such ideas in their own magazines and Internet offers the amateur physicist ample opportunity to show them too.

As a result the only difference between a professional and an amateur physicist is that the professional one gets money for his fantasy!

To show an extreme belief maintained by a, rather restricted I assume, group of amateur physicists: vacuum still contains a certain substance that should be called 'ether'. Confronting them with the consequence that, given the specification of this substance, its mass density must be about  $10^{14}$  kg/m<sup>3</sup>, they don't even blink with their eyes, while pretending that such a consequence is not a problem at all.

However, the scientific establishment created an at least as stupid fantasy called Quantum Electro Dynamics, in which the so-called quantum vacuum state plays a dominant role. The chapter "Quantum Electro Dynamics: a fully fuzzy fantasy" presents some backgrounds of this "theory".

And last, but not least: scrutinizing Einstein's article about the Special Theory of Relativity shows that his mistakes in his mathematics are so extremely obvious that one can hardly believe that he didn't make them purposely. The arguments are presented in: "Special Theory of Relativity based on fraudulent science?".

I don't envy the current physicist, neither the professional nor the amateur, but especially not the future physicists. They will be immersed in a completely foolish physical world that may no longer be referred to as physics, but that only deserves the designation "physics".

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# I Einstein's and Galilei's Principle of Relativity

*Summary - The Special Theory of Relativity (STR) proposed by Einstein in 1905, is based on two presumptions: the first one, labelled by Einstein as the Principle of Relativity (PoR), and the second one defining the supposed property of the speed of light in vacuum. This chapter shows how close Einstein, as well as Lorentz, has been to a solid solution of the problems physicists encountered a century ago, observing electromagnetic phenomena. It also shows that Einstein's PoR is a fundamentally restricted version of Galilei's Principle of Relativity.*

## 1 Introduction

The so-called negative result of the experiment of Michelson and Morley urged physicists a century ago to find a solution for the fundamental problem showing up by that result. The Special Theory of Relativity emerged as a presumed answer to the problem. In order to try to understand the foundation of this theory, some text written by Einstein has been analysed in detail in this chapter. Doing so, it turned out that it is also important to show some text of Lorentz, written in the year before Einstein presented his article about STR.

## 2 The distinction between axiom, postulate, hypothesis and theorem

The common property of the first three concepts is that they all express a presumption. There are as many definitions of these three concepts as there are users of them. For that reason it is considered necessary to show the definitions meant in this chapter.

An axiom is a presumption of which its validity is strongly self-evident.

A postulate is a presumption considered valid as long as it has not been proven to be invalid.

A hypothesis is a presumption of which it is required that its validity has yet to be proven.

A theorem is a logical result of presumptions of whatever kind.

## 3 Historical review

The historical review concerns a description, by Lorentz in 1904, of the problems regarding the ether model in relation to the velocity of light, copied in appendix I from reference [1] and a copy of a part of the beginnings of Einstein's translated article: On the electrodynamics of moving bodies, originally written in 1905. See appendix II.

Appendix I shows that Lorentz must have been looking for a postulate, he called it a fundamental assumption, that would lead to the result:

*"..... that many electromagnetic actions are entirely independent of the motion of the system."* (Reference [3] shows that Lorentz was searching for evidence of an absolute frame of reference.) Strange however that he would already have been satisfied if only many, so not all, "*electromagnetic actions*" would be "*independent of the motion of the system*".

That does of course raise the question which actions would have to be excluded and why.

Appendix II shows that Einstein's word 'Vermutung' has been translated into 'conjecture' and his word 'Voraussetzung' into 'postulate'. Most likely Einstein (indeed) meant with his word 'Voraussetzung' a presumption, considered valid as long as it has not been proven to be invalid, here defined as postulate.

Besides these two German words Einstein also used the word "Prinzip", of course translated as "principle". The end of Appendix II shows that Einstein should have used the word "postulate", where he used the word "principle". "Principle" can hardly be distinguished from "axiom".

The most important, (at least in the opinion of the author,) conclusion that can be drawn from Appendix II is that Einstein's postulate, named Principle of Relativity (PoR), is not equivalent to the "now-a-days" postulate, also named Principle of Relativity.

This postulate (or should it be qualified as an axiom?) sounds:

*Each physical law is the same in any inertial system.*

This results in the conclusion that:

*Each experiment carried out in any inertial system shows the same result.*

Einstein's PoR is a fundamentally restricted version of the now-a-days one: it (only) states that in case of two arbitrary inertial systems, *moving w.r.t. each other*, it will not make any difference whether the coordinates of the one or the other system are taken as reference for the description of those physical laws that describe the mutual interactions of the physical processes in these two inertial systems. Copied from [2]:

*"It is known that Maxwell's electrodynamics—as usually understood at the present time—when applied to moving bodies, leads to asymmetries which do not appear to be inherent in the phenomena. Take, for example, the reciprocal electro-dynamic action of a magnet and a conductor. The observable phenomenon here depends only on the relative motion of the conductor and the magnet, whereas the customary view draws a sharp distinction between the two cases in which either the one or the other of these bodies is in motion."*

We now can conclude:

- that it was Einstein who introduced the postulate named 'Principle of Relativity',
- that he used the word "relativity", in order to express the mutual interaction of physical processes in two arbitrary inertial systems moving *relative* to each other,
- that he wanted to express too, by choosing the word *relative*, that a frame of reference in *absolute* rest had to be rejected,
- that his PoR is a fundamentally restricted version of the "now-a-days PoR",
- that the name of the "now-a-days PoR" should therefore not be Principle of Relativity.

As a result it is proposed to qualify:

### **Each physical law is the same in any inertial system**

as an axiom and to name it:

### **Galilean's Principle of Relativity**

meant to express the relativity that originally has been proposed by Galileo Galilei and to honour him posthumously for this extraordinary important axiom.

The applied abbreviation for this axiom in this chapter will be GPR.

Reference [4] shows:

"Galileo put forward the basic principle of relativity, that the laws of physics are the same in any system that is moving at a constant speed in a straight line, regardless of its particular speed or direction. Hence, there is no absolute motion or absolute rest. This principle provided the basic framework for Newton's laws of motion", but presents a fundamental error by adding: "and is central to Einstein's special theory of relativity.", as has been shown above.

## 4 Einstein's postulate regarding the speed of light

As shown in Appendix II, Einstein proposed the following postulate regarding the property of the speed of light:

*“Any ray of light moves in the “stationary” system of co-ordinates with the determined speed  $c$ , whether the ray be emitted by a stationary or by a moving body.”*

Einstein's mathematical relations between time, distance and speed of light show his perception of the property of the speed of light in the following situation. A light ray moves in the “stationary” system with speed  $c$  in the direction of a moving rod  $r_{AB}$  (with speed  $v$  w.r.t. that “stationary” system) passing the one end point A of the rod at  $t_A$ , reflected at the other end point B of the rod at  $t_B$  and again passing A at  $t'_A$ . It shows that the speed of light is taken  $c-v$  w.r.t. the rod on the way out and  $c+v$  w.r.t. the rod on the way back:  $t_B - t_A = r_{AB}/(c - v)$  resp.  $t'_A - t_B = r_{AB}/(c + v)$ .

The fundamental error in Einstein's second postulate is that he effectively reintroduced with his “stationary” system the ether model, most likely without noticing it, because he rejected the ether model himself in the same article. It is generally accepted that an absolute stationary system does not exist. As a result only a stationary system w.r.t. another system can exist. As a consequence that other system is also stationary w.r.t. the first mentioned one. Therefore the introduction of a “stationary” system is senseless, whether it is put in quotes or not. Einstein even defined it as *the* “stationary” system:

*“Let us take a system of co-ordinates in which the equations of Newtonian mechanics hold good?. In order to render our presentation more precise and to distinguish this system of co-ordinates verbally from others which will be introduced hereafter, we call it the “stationary” system. (Note 2: i.e. to the first approximation.)”*

Regarding this definition it might be that Einstein (only) meant ‘inertial system’. However, there are two reasons to reject that possibility.

In the above quoted postulate Einstein clearly means ‘not moving’ with ‘stationary’: “.....emitted by a stationary or by a moving body”.

Secondly, the equation  $t'_A - t_B = r_{AB} / (c + v)$  shows that after reflection (at point B of the rod) the speed w.r.t. Einstein's “stationary” system is indeed still supposed to be  $c$ , notwithstanding the situation that the propagation direction is reversed and the reflector is moving with speed  $v$  w.r.t. that “stationary” system.

The ether model prescribed such a property too, and Michelson and Morley based their experiment on this supposed property: the ether determines the speed of light, not the source or reflector! So Einstein indeed effectively reintroduced an ether-like model with the introduction of his “stationary” system.

This fundamental error could have been the main reason for the fact that the community of physicists changed Einstein's postulate to: *the speed of light is  $c$  w.r.t. whatever reference*, clearly in contradiction with his postulate and with his two equations shown above. That same community however did not change Einstein's theoretical considerations. Given the GPR, both postulates can be proven to be incorrect.

## 5 Theorem Concerning the Reference for $c$

Based on the GPR, the following theorem can be built up regarding the speed of light:

- The emission of light by a source is based on certain physical laws.
- The speed of light in free space as well as in a tangible medium can be calculated by means of the Maxwell equations.
- Due to the fact that these equations do not show any relation with the source, the calculation of the speed of light in a tangible medium must only concern the situation that the source is in rest w.r.t. that medium. As a result this speed is referenced to the source as well as to the medium.



- Replacing the tangible medium by free space eliminates the last mentioned reference.
- What is left is that the speed of light in free space is  $c$  w.r.t. its source.
- The GPR now forces us to conclude that in all inertial systems in free space the speed of light, emitted by a source fixed in that system, is  $c$ .

Formulated in a shorter way:

A light source in free space emits light with propagation speed  $c$  w.r.t. that source.

Due to the fact that a reflection is, just like an emission, a physical process, the mentioned theory is also applicable in case of a reflector.

In case the light source/reflector is not an inertial system itself, the theorem has to be changed to: the speed of light in free space is  $c$  w.r.t. its source/reflector, at the moment of emission/reflection.

## 6 Einstein's perception regarding the Phenomenon 'Time'

Einstein's perception of time was developed from the point of view of his definition of simultaneity. This definition forced him to introduce different times in different inertial systems. Most likely as a result, he did not introduce a formal hypothesis about 'time'.

The GPR applied to atomic clocks operating in inertial systems leads to the following consideration:

- Atomic clocks measure time, based on certain physical laws.
- The GPR thus prescribes that atomic clocks in principle measure the same time in all inertial systems.
- STR claims that atomic clocks will not measure the same time in inertial systems with mutual different velocities.
- STR thus contradicts the GPR regarding the time transformation as function of speed.

In general: the GPR forces us to conclude that time is universal!

So, all experiments that claim to support time dilation, must have been carried out incorrectly, or interpreted incorrectly, or both.

## 7 The mysterious observer in STR

Einstein's idea behind the phenomenon observer is that he created the solution to the following theoretical "problem": how can we *observe/measure* the simultaneity of events, applying light signals?

Einstein created two fundamental problems, putting forward the alleged importance of simultaneity.

- There is no simultaneity problem at all: now here equals now there, wherever 'there' might be, and independent of speed too, as proven above.
- Einstein ignored pure physics by not carefully distinguishing between Theory on the one hand and Measurement on the other hand.

A theory, by definition, does not rely on measurement. A physical theory describes what happens physically. The measurement of what physically happens is a fundamentally different thing. Several measurements have been carried out in order to verify a theory. Verifying the validity of STR would, regarding the alleged importance of the observer, for example, mean: measure the observation of some mysterious observer, observing the time measurement of two clocks, moving with mutual different speed.

The ridiculousness of such a verification process is self-evident.

## 8 Einstein's mathematical manipulation

By manipulating his mathematics at a certain point, Einstein succeeded in presenting consistent transformation formulas. 'Consistent' regarding the property of these formulas that, after transforming the coordinates  $x$  and  $t$  from system  $S$  to System  $S'$ , the original coordinates in  $S$  are found again applying the same formulas with the appropriate variables.

This manipulation concerns the variable  $x$ , being a constant in  $S$  at the start of his mathematics, defined as  $x = ct$  at the point of manipulation and again as constant after that.

Without this manipulation he would not have succeeded in realising these 'consistent' transformation formulas.

So, in his heart, Einstein must have known that his assertion below was fanfaronade:

*"those who claim to be able to prove experimentally that STR is invalid, carried out / interpreted their experiment wrongly".*

The truth is found by changing the word 'invalid' in 'valid'.

## 9 Speed of light in a moving medium

Speaking about a moving medium requires in the first place the definition of the reference of the speed of that medium. The most logical reference is the source of the light of which we want to determine the propagation speed. Secondly it is necessary to define the reference for this speed of light. That can be its source, but also the (moving) medium.

In 1818 Fresnel deduced the mathematical expression for the speed of light in a moving medium. His expression shows the so-called drag coefficient of Fresnel. He deduced this expression, assuming that the 'medium' ether was necessary for the propagation of light and at the same time being an absolute reference for whatever velocity. Fizeau experimentally proved the correctness of this expression in 1851:  $c_m' = c_m + v(n^2 - 1)/n^2$ .

If, instead of what Fresnel assumed, not the ether is taken as the reference for all mentioned velocities, but the source of the light, then this equation has to be interpreted with the following definitions:

$v$  = the speed of the medium w.r.t. the source, positive in the propagation direction of the light

$n$  = the refractive index of the medium

$c_m$  =  $c/n$  the speed of light w.r.t. its source for  $v=0$

$c$  = the speed of the light w.r.t. its source in vacuum

$c_m'$  = the speed of light w.r.t. its source for  $v$  not equal zero

Most likely the expression of Fresnel never has been subject of discussion after the medium ether had been abandoned. So be it. By defining the source as the reference for the speed of light and for the velocity of the medium, Fresnel's expression can, without any restriction, be maintained.

As the expression shows: for vacuum ( $n=1$ ) yields:  $c_m' = c_m = c$ , the speed of the light w.r.t. its source!

Astronomical light entering the atmosphere of our earth does have a speed, w.r.t. the atmosphere/earth, of say  $c+v_{ri}$ . The speed  $v_{ri}$  represents in first instance, which means at the moment of emission, the mutual speed between the earth and the celestial object at the mentioned moment, an arbitrary time ago. At the moment of receipt the earth is in an arbitrary position in its orbit around the sun and thus has an arbitrary speed compared to the moment of emission. The speed  $v_{ri}$  thus is at the moment of receipt  $v_{rr}$ . So, in general  $v_{rr}$  is (completely) unknown. However this speed equals the  $v$  in the above shown expression of Fresnel.

The refraction index  $n$  in this situation is not uniquely defined, because it starts with a value very close to 1 and it is about 1.0003 near the surface of the earth. But the final so-called drag coefficient of Fresnel:  $(n^2 - 1)/n^2$  is of course determined by the refractive index in the neighbourhood of the receiver on earth.

## Conclusions

1. In the development of his STR, Einstein used velocities larger than  $c$ , clearly in contradiction with his own conclusion that there are no velocities larger than  $c$ .
2. Einstein's postulate regarding the reference for the speed of light in vacuum has been rejected by the community of physicists and replaced by the postulate clearly in contradiction with the one of Einstein.
3. It has been proven that neither the one nor the other postulate regarding the speed of light is correct, by showing the theorem that the speed of light can only be  $c$  w.r.t. its source (at the moment of emission in case the source is not an inertial system).
4. Time must be the same in all inertial systems, based on the Principle of Galilei's Relativity: each physical law is the same in whatever inertial system.
5. The phenomenon 'observer', as introduced by Einstein in his STR, has been proven to be a self-evident ridiculous phenomenon.
6. Einstein created a mathematical error that strongly gives the impression of manipulation.
7. As a result the Special Theory of Relativity is an untenable theory.
8. The introduction of the theorem that the speed of light in vacuum is  $c$  w.r.t. its source does not have any influence on the expression of Fresnel, showing the speed of light in a medium moving w.r.t. the source.

## References

- [1] Electromagnetic phenomena in a system moving with any velocity smaller than that of light, Prof. H. A. Lorentz, Proceedings of the Royal Netherlands Academy of Arts and Sciences, 1904, 6: 809–831. Copy of original text found at: <http://www.dwc.knaw.nl/DL/publications/PU00014148.pdf>
- [2] Translated original article of Einstein:  
On the electrodynamics of moving bodies, By A. Einstein, June 30, 1905  
<http://www.fourmilab.ch/etexts/einstein/specrel/www/>
- [3] [https://en.wikipedia.org/wiki/Lorentz\\_ether\\_theory](https://en.wikipedia.org/wiki/Lorentz_ether_theory)
- [4] [https://en.wikipedia.org/wiki/Galileo\\_Galilei](https://en.wikipedia.org/wiki/Galileo_Galilei)

## Appendix I

### Lorentz's opinion about the consequences of the negative result of M & M's experiment.

As shown in [1] Lorentz wrote in 1904:

“§ 2. *The experiments of which I have spoken are not the only reason for which a new examination of the problems connected with the motion of the Earth is desirable. POINCARÉ<sup>4</sup> has objected to the existing theory of electric and optical phenomena in moving bodies that, in order to explain MICHELSONS'S negative result, the introduction of a new hypothesis has been required, and that the same necessity may occur each time new facts will be brought to light. Surely, this course of inventing special hypotheses for each new experimental result is somewhat artificial. It would be more satisfactory, if it were possible to show, by means of certain fundamental assumptions, and without neglecting terms of one order of magnitude or another, that many electromagnetic actions are entirely independent of the motion of the system. Some years ago, I have already sought to frame a theory of this kind. I believe now to be able to treat the subject with a better result. The only restriction as regards the velocity will be that it be smaller than that of light.*”

## Appendix II

### Einstein's opinion about the consequences of the negative result of M & M's experiment.

As shown in [2] Einstein wrote in 1905:

“*It is known that Maxwell's electrodynamics—as usually understood at the present time—when applied to moving bodies, leads to asymmetries which do not appear to be inherent in the phenomena. Take, for example, the reciprocal electro-dynamic action of a magnet and a conductor. The observable phenomenon here depends only on the relative motion of the conductor and the magnet, whereas the customary view draws a sharp distinction between the two cases in which either the one or the other of these bodies is in motion. For if the magnet is in motion and the conductor at rest, there arises in the neighbourhood of the magnet an electric field with a certain definite energy, producing a current at the places where parts of the conductor are situated. But if the magnet is stationary and the conductor in motion, no electric field arises in the neighbourhood of the magnet. In the conductor, however, we find an electromotive force, to which in itself there is no corresponding energy, but which gives rise—assuming equality of relative motion in the two cases discussed—to electric currents of the same path and intensity as those produced by the electric forces in the former case.*

*Examples of this sort, together with the unsuccessful attempts to discover any motion of the earth relatively to the “light medium,” suggest that the phenomena of electrodynamics as well as of mechanics possess no properties corresponding to the idea of absolute rest. They suggest rather that, as has already been shown to the first order of small quantities, the same laws of electrodynamics and optics will be valid for all frames of reference for which the equations of mechanics hold good. We will raise this conjecture (the purport of which will hereafter be called the “Principle of Relativity”) to the status of a postulate, and also introduce another postulate, which is only apparently irreconcilable with the former, namely, that light is always propagated in empty space with a definite velocity  $c$  which is independent of the state of motion of the emitting body. These two postulates suffice for the attainment of a simple and consistent theory of the electro-dynamics of moving bodies based on Maxwell's theory for stationary bodies. The introduction of a “luminiferous ether” will prove to be superfluous inasmuch as the view here to be developed will not require an “absolutely stationary space” provided with special properties, nor assign a velocity-vector to a point of the empty space in which electromagnetic processes take place.”*

Two pages further:

#### “§ 2. *On the Relativity of Lengths and Times*

*The following reflexions are based on the principle of relativity and on the principle of the constancy of the velocity of light. These two principles we define as follows:*

*1. The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of co-ordinates in uniform translatory motion.*

*2. Any ray of light moves in the “stationary” system of co-ordinates with the determined velocity  $c$ , whether the ray be emitted by a stationary or by a moving body.”*

## II $E=mc^2$ : a self-evident non-physical equation

*Summary - This chapter shows, from several points of view, why the equation  $E=mc^2$  must be an untenable equation.*

### 1 Introduction

The equation  $E=mc^2$  is a result of the General Theory of Relativity, which is, on its turn, a result of the Special Theory of Relativity.

Mind-blowing, but above all shocking, from a scientific point of view, is the myth around this equation.

### 2 Kinetic energy considerations

The equation  $E=mc^2$  suggests a kinetic energy, with the problem that it doesn't fit with the expression  $E=\frac{1}{2}mv^2$ , replacing  $v$  by  $c$ . Because  $E=\frac{1}{2}mv^2$  is a correct equation without any doubt,  $E=mc^2$  can't be correct as well. Why isn't it possible that  $E=\frac{1}{2}mv^2$ , with  $v=c$ ? If there would be a reason for that, might it be then that  $v$  equals  $c-\epsilon$  with  $\epsilon$  arbitrarily small?

The mass in the equation under consideration is not just a normal mass but, according to the GTR, a so-called relativistic mass, of which the value depends on its *constant* velocity  $v$ , mathematically written as:

$$m = m_{\text{rest}} / \sqrt{1-v^2/c^2} .$$

Based on the approximation:  $1/\sqrt{1-\epsilon} \sim 1+\epsilon/2$ ,  $m$  can also be written as:

$$m \sim m_{\text{rest}}(1 + \frac{1}{2} v^2/c^2)$$

Both sides of this equation multiplied with  $c^2$  results in:

$$mc^2 \sim m_{\text{rest}}c^2 + \frac{1}{2}m_{\text{rest}} v^2$$

Quoted from Wikipedia (a few years ago):

*The first term  $m_{\text{rest}}c^2$  is large, but stays unchanged in daily live, so we will hardly observe, except in case of, for example, nuclear power.*

The term  $m_{\text{rest}}c^2$  is called rest energy.

Mind alone the word, its contradiction in itself and the fact that  $m_{\text{rest}}$  can only be in rest relative to an object that has the same velocity as  $m_{\text{rest}}$ .

Later on in Wikipedia the "importance" of this equation has been accentuated by stating:

*"Due to the enormous factor  $c^2$  in the formula, 1 gram mass corresponds with  $8,988 \times 10^{13}$  joule. This is the heating energy of 15 000 barrels crude oil, but also the energy of a bomb of 21.4 kiloton TNT: the same order of magnitude as the atomic bomb Little Boy that destroyed Hiroshima."*

Very impressive that, for example, a flint of say 10 gram does have a rest-energy equivalent to the heating energy of 150.000 barrels crude oil, which we hardly "observe in daily live". An energy also equivalent to an atomic bomb with which 10 Hiroshima's can be destroyed. A flint as Big Boy.

### 3 Relativistic mass considerations

Firstly:

A fundamental question regarding the “mass at rest” is: what is the chosen reference for determining a mass at rest? No mass is at rest at all in an absolute sense. It always has a velocity and is only in rest relative to an object with the same velocity.

Secondly:

If a mass does have a velocity  $v_1$  relative to reference 1 and velocity  $v_2$  relative to reference 2, then it would have, at the same time, different relativistic masses, only depending on the reference that is taken to determine its velocity.

In as well the STR as the GTR such contradictions are “explained” by stating that the mentioned references have to be considered as observers, which *observe* these mutual different relativistic masses.

In these theories it has never been specified at all how such an *observation* is carried out.

Besides that, this “explanation” contains two fundamental errors:

1. In genuine physics, theory and measurement are carefully distinguished. A theory describes what physically happens. In order to verify a theory, measurements have to be carried out. In STR and GTR these two things are mixed up: the theory includes already “measurements”.
2. A mass of which its value would depend on its constant velocity contradicts with the Principle of Relativity\*, the postulate in physics that states that physical laws are the same in all inertial systems. As a result: certainly the value of a mass is constant.

So, in genuine physics mass does have a certain constant value, independent of its velocity, and if two observers would observe mutual different values, at least one observer carried out a wrong measurement.

#### **Conclusion:**

The equation  $E=mc^2$  is, considered from several points of view, a nonsense equation, leading to ridiculous conclusions about the amount of energy of masses “in rest”, added to the undefined reference regarding that “in rest”.

\*In chapter I named: Galilean’s Principle of Relativity

### III Maxwell's equations, Einstein's Special Theory of Relativity and the Lorentz transformation: a historical review

*Summary - The chapter shows that a lot of misunderstanding and confusion has been originated after Einstein published his article about the STR. Fundamental errors, manipulative mathematics and an unfounded believe in the transformation formulas of the STR caused this chaos.*

#### 1 Maxwell's equations

The remarkable property of the Maxwell equations is that they don't show any relation with the source of an EM-field, notwithstanding the fact that one can calculate, by means of the wave equations for the electrical and magnetic field, the propagation velocity of such a field. The outcome for vacuum is the well-known propagation velocity  $c=1/\sqrt{\epsilon_0\mu_0}$ . So in first instance it looks like  $c$  doesn't have or need a reference. The background for this apparent non-physical property is the following.

Maxwell lived from 1831 until 1879, which is the last part of the, centuries long, period during which the standard opinion was that the intangible medium ether "filled" the whole universe. It was assumed to be in absolute rest and be necessary for the propagation of EM-fields. Moreover, the opinion was that the propagation velocity of an EM-field would only be  $c$  w.r.t. this ether, so independent of the velocity of the source w.r.t. this ether.

N.B. *Sound has exactly the same property regarding its propagation velocity in, for example, water and air. It is independent of the velocity of its source w.r.t. that medium.*

In 1818 Fresnel deduced the mathematical expression for the velocity of light in a moving tangible medium. This expression shows the so-called drag coefficient of Fresnel. He deduced this expression, based on the same opinion as described above, assuming that the ether is not any more at absolute rest w.r.t. a moving transparent tangible medium. As he described it: the ether is dragged by a small fraction of the velocity between ether and transparent medium. Fizeau experimentally proved the correctness of Fresnel's equation in 1851. So why would any physicist doubt about this ether!

Michelson and Morley lived in the same century as Maxwell, Fresnel and Fizeau. They developed their well-known experiment based on the just described opinion in the period 1880-1890. The consequence of this opinion namely is that the earth also has to have a measurable velocity in the universe w.r.t. this ether.

No wonder that the whole physical world was astonished by the negative outcome of their experiment!

#### 2 Einstein's Special Theory of Relativity

Einstein abandoned the ether together with the introduction of his STR. But at the same moment he made a fundamental error: he replaced the ether by an equivalent system "in rest". The quotes have been added by him. The explanations in his article of 1905 clearly show that his system "in rest" has exactly the same properties as the ether he rejected.

By manipulating his mathematics at one point, he succeeded in presenting consistent transformation formulas. 'Consistent' regarding the property of these formulas that, after transforming the coordinates  $x$  and  $t$  from system  $S$  to System  $S'$ , the original coordinates in  $S$  are found applying again the same formulas with the appropriate variables. The mentioned manipulation concerns the variable  $x$ , being a constant in  $S$  at the start of his mathematics, defined as  $x=ct$  at the point of manipulation and again this constant after that. See Chapter I.

### 3 The chaos

At a certain moment the community of physicists seemingly discovered Einstein's fundamental error, regarding his system "in rest". Instead of publishing this error loud and clear, it slinky changed Einstein's hypothesis. The system "in rest" changed to a much more stupid hypothesis: the velocity of light in vacuum from that moment on became  $c$  w.r.t. whatever reference / inertial system!

One article has been found that tries to present the mathematics that lead to that same 'consistent' transformation formulas as Einstein generated, notwithstanding the fact that the author based them on a fundamental different hypothesis! It is written by Professor S. Bentvelsen, in Dutch.

[http://www.nikhef.nl/~stanb/download/SRT2010/SYLLABUS\\_2010.pdf](http://www.nikhef.nl/~stanb/download/SRT2010/SYLLABUS_2010.pdf)

It shows even more manipulative mathematics than Einstein's article does!

### 4 Lorentz transformation

One of the frequently used arguments that the STR is a correct theory is the claim that the Maxwell equations are invariant under the Lorentz transformation. The background is the following.

What is meant here with the Lorentz transformation is specifically and only the velocity transformation:

$$v_x' = (v_x - v_R) / (1 - v_R v_x / c^2)$$

with  $v_R$  the relative velocity of S and S',  $v_x$  the velocity of x in S and  $v_x'$  the velocity of x' in S'.

It can be deduced simply from the coordinate and time transformation as produced by Einstein.

See the appendix.

That means that this velocity transformation is not deduced by Lorentz and thus has a misleading name. Lorentz developed his own time and coordinate transformation, most times called contraction formulas. They look like Einstein's formulas, but are significant different. See Reference.

$$\text{Einstein: } t' = \beta(t - v_R x / c^2) \quad \text{and} \quad x' = \beta(x - v_R t)$$

$$\text{Lorentz: } t' = \beta(t / \beta^2 - v_R x / c^2) \quad \text{and} \quad x' = \beta x.$$

The velocity transformation shows that if  $v_x$  in S equals  $c$ ,  $v_x'$  in S' also equals  $c$ .

However this property is in contradiction with the second hypothesis of Einstein:

*Each light beam moves in the coordinate system "in rest" with the specific velocity  $c$ , independent of the fact whether this light beam has been emitted by a body at rest or a moving body.*

Further on Einstein calculates the time periods that light needs to travel along rod  $r_{AB}$ , as  $r_{AB} / (c - v_R)$  on the way forth, resp.  $r_{AB} / (c + v_R)$  on the way back  $r_{AB}$ .

The rod moves with velocity  $v_R$  w.r.t. to the system "in rest". The light is reflected at point B of this rod.

The rod is effectively an inertial system w.r.t. which the velocity of light should be  $c$ , according to the velocity transformation, but is clearly not the fact in Einstein's theory.

The property of the velocity transformation must have led to the situation that Einstein's original hypothesis has been changed to the one that says that the velocity of light in vacuum is  $c$  w.r.t. whatever reference and is used to claim that the Maxwell equations are invariant under this transformation.

Given the fundamental contradiction of the 'Lorentz' transformation with Einstein's hypothesis, together with the presented manipulative mathematics, it must be concluded that the claim is worthless.



## Conclusion

The Maxwell equations don't have any relation with the STR, nor with the 'Lorentz' transformation and can perfectly be applied without these by taking the proven theory that the propagation velocity of light in vacuum is only  $c$  w.r.t. its source.

## Reference

Electromagnetic Phenomena in a system moving with a velocity smaller than any velocity than that of light. Prof. H.A. Lorentz, Royal Dutch Academy of Sciences 6 (1904), pages 809-831

## Appendix

### Derivation of the velocity transformation

Einstein's transformation formulas are:

$$\begin{aligned}x' &= \beta(x - v_R t) \\t' &= \beta(t - v_R x / c^2) \\ \beta &= 1 / \sqrt{1 - (v_R / c)^2}\end{aligned}$$

with  $x$  and  $t$  defined in  $S$ ,  $x'$  and  $t'$  defined in  $S'$  and with  $v_R$  the relative velocity of  $S$  and  $S'$ .

Replacing  $x$  by  $v_x t$ , representing a velocity  $v_x$  of  $x$  in  $S$ , results in:

$$\begin{aligned}x' &= \beta(v_x - v_R) t \\t' &= \beta(1 - v_R v_x / c^2) t\end{aligned}$$

Defining  $v_x'$  as the velocity of  $x'$  in  $S'$  results in:

$$v_x' = x' / t' = (v_x - v_R) / (1 - v_R v_x / c^2)$$

*If  $v_x = c$  then  $v_x'$  is also  $c$ , being fundamentally in contradiction with the hypothesis on which Einstein based his STR: the velocity of light is only  $c$  in the system "in rest"!*

## IV Analysis of the Around-the-World atomic clocks experiment

*Summary - The description of the experiment, published in 1972 in Science by J.C. Hafele and R.E. Keating, shows in the first part, called: Predicted Relativistic Time Gains, the theoretical background for the calculated time gains. In the second part: Observed Relativistic Time Gains, the results of the measurements are shown. This chapter shows several theoretical errors and a tendentious presentation of the measurements, so clear that the reader cannot avoid a feeling of being deceived in order to get convinced of the correctness of the Special Theory of Relativity.*

### Analysis

The basic idea is to differentiate the time transformation formula with respect to  $t$ , leading to:

$$d\tau/dt = d\{\beta(t - (v/c^2)x)\}/dt, \quad \text{with: } \beta = 1/\sqrt{1-v^2/c^2} \quad \text{See Reference.}$$

It turns out that the authors didn't realize that the variable  $x$ , in the theory as described by Einstein, is defined as a constant in the system  $K$  in rest. ( $x$  is projected in the system  $k$ , moving with constant velocity  $v$  in the direction of the  $x$ -axis w.r.t.  $K$ , so only this projection is a function of time.)

In the differentiation process they have written  $dx/dt$  as  $v$ , while it is zero.

Doing so, the result is the formula applied by them:  $d\tau/dt = (1-v^2/c^2)^{+1/2} \sim 1 - v^2/2c^2$ .

However applying  $dx/dt=0$  would have resulted in:  $d\tau/dt = (1-v^2/c^2)^{-1/2} \sim 1 + v^2/2c^2$ .

This change of sign plays an essential role in the predicted time-gain / time-loss between the stationary and flying clocks.

The table below shows the predicted time-gain / time-loss between the stationary and flying clocks, presented as nsec per day, for  $d\tau/dt = 1 - v^2/2c^2$  ("published"), respectively for  $d\tau/dt = 1 + v^2/2c^2$  ("correct  $d\tau/dt$ ").

<i>effect</i>	<b>published</b>		<i>effect</i>	<b>correct <math>d\tau/dt</math></b>	
	eastward	westward		eastward	westward
gravitational	144	179	gravitational	144	179
kinematic	-184	96	kinematic	184	-96
net	-40	275	net	328	83

Remarks:

1. The measurements have been carried out with a 707 and a Concorde.
2. The gravitational time difference, predicted by the GTR as the authors claim, is calculated as  $gh/c^2$ , with  $g=9,8\text{m/s}^2$  and  $h$  the height of the airplane.
3. The value 179 follows from an height of 19000 m, clearly the height of the Concorde.
4. The normal flight height of a 707 is 10000 m, but that height would lead to 94 nsec.
5. The value 144 is found when the height would be 15300 m, clearly the mean value of the heights of the Concorde and the 707.
6. That means that it may be expected that the kinematic contribution is also a mean value of both airplanes

The following questions can now be asked:

1. Why have these values been mixed? Nothing has been explained about this approach. The reader has to find out this by himself, by checking the presented numbers.
2. There has been a Concorde flying westward, of which the results are presented separately. There must also have been a Concorde flying eastward. Why are the results of this flight not presented separately?
3. The same question can be asked for the 707, flying eastward.
4. Might it be that only the mixed value showed enough similarity?
5. Was the so-called predicted value of these mixed flights really predicted, or calculated after the experiment had been carried out and evaluated?
6. Regarding the accuracy of the observations: isn't it accidentally that they observed the (wrong) predicted time gains with a claimed accuracy of not more than 10 nsec per day, while, as they wrote:

“However, no two “real” cesium beam clocks keep precisely the same time, even when located together in the laboratory, but generally show systematic rate (or frequency) differences which in extreme cases may amount to time differences as large as 1000 nsec per day.”

and:

“A much more serious complication is caused by the fact that the relative rates for cesium beam clocks do not remain precisely constant. In addition to short term fluctuations in rate caused mainly by shot noise.....”

and:

“These unpredictable changes in rate produce the major uncertainty in our results.”

Besides the error in the expression for  $d\tau/dt$  the authors overlooked another fundamental phenomenon. They wrote:

“Because the earth rotates, standard clocks distributed at rest on the surface are not suitable in this case as candidates clocks of an inertial space. Nevertheless, the relative timekeeping behaviour of terrestrial clocks can be evaluated by reference to hypothetical coordinate clocks of an underlying nonrotating (inertial) space (6).

For this purpose, consider a view of the (rotating) earth as it would be perceived by an inertial observer looking down on the North Pole from a great distance. A clock that is stationary on the surface at the equator has a speed  $R\Omega$  relative to nonrotating space, and hence runs slow relative to hypothetical coordinate clocks of this space in the ratio  $1-R^2\Omega^2/2c^2$ , where  $R$  is the earth's radius and  $\Omega$  its angular speed. On the other hand, a flying clock circumnavigating the earth near the surface in the equatorial plane with a ground speed  $v$  has a coordinate speed  $R\Omega+v$ , and hence runs slow with a corresponding time ratio  $1-(R\Omega+v)^2/2c^2$ . Therefore, if  $\tau$  and  $\tau_0$  are the respective times recorded by the flying and ground reference clocks during a complete circumnavigation, their time difference, to a first approximation, is given by  $\tau - \tau_0 = -(2R\Omega v + v^2) \tau_0 / 2c^2$ .”

Why did the authors choose for this position of the “inertial observer”, in stead of an observer at such a great distance with respect to earth that ‘it’ would have observed not only the velocities as described, but also the velocity, let say  $w$ , of the earth due to its rotation around the sun? This velocity not only is much larger than  $R\Omega$  and  $v$  ( $\sim 100000$  km/hour), it would also have led to a completely different theoretical consideration, not only due to the fact that the influence of  $w$  is very large on the result, but also due to the fact that  $R\Omega$  and  $v$  are continuously differently oriented with respect to  $w$ .

Incorporating the influence of  $w$  would lead to the velocity for the ground reference clock:

$v_r = w + R\Omega\cos\Omega t$ , respectively for the airplane:  $v_a = w + (R\Omega + v_r)\cos(\Omega t + \varphi(t))$ , with  $\varphi(t)$  representing the position of the airplane w.r.t. the position of the ground reference clock.

Due to the square of the velocities  $v_r$  and  $v_a$  in the expression for  $\tau - \tau_0$  the influence of  $w$  on the this time difference is very large.

Maybe our earth does have yet another velocity, together with our solar system, maybe even much larger than  $w$ ! However (the position in universe of) the reference of this velocity is unknown, so the “hypothetical inertial observer” cannot be placed.

## **Conclusion**

Due to the most fundamental theoretical errors and the clear tendentious and biased presentation of their measurements, J.C. Hafele and R.E. Keating have been compelled, or by themselves or by the scientific establishment, to “prove” the correctness of the Special Theory of Relativity, whatever they might have measured.

It is therefore, from a scientific point of view, all the more poignant to have to read in their article their next statement.

“In science, relevant experimental facts supersede theoretical arguments.”

## **Reference**

[http://www.personal.psu.edu/rq9/HOW/Atomic\\_Clocks\\_Predictions.pdf](http://www.personal.psu.edu/rq9/HOW/Atomic_Clocks_Predictions.pdf)

## V From astronomical to terrestrial light

*Summary - One of the claims that the Special Theory of Relativity is a valid theory is that experiments seem to prove that the velocity of astronomical light reaching the surface of our earth is always  $c$ . This chapter shows that such a conclusion is wrong and it also shows that, applying the so-called ballistic theory to light, a sinusoidal shaped Doppler shift of binary pulsars will be detected.*

### 1 Introduction

In chapter I the theorem is proven that the propagation velocity of light in vacuum is only  $c$  with respect to its source, rejecting the hypothesis on which the STR is based.

Chapter III emphasizes the incorrectness of the STR from an historical point of view.

The content of this chapter is based on the mentioned theorem.

### 2 Astronomical light

Astronomical light is defined as light that has been emitted by astronomical bodies.

Such light reaches our earth normally after a very long time. Based on the theorem mentioned in the Introduction, astronomical light will normally not reach the earth with velocity  $c$  w.r.t. to the earth. In order to be strictly correct and because it is essential in this consideration, the theorem has to be presented as: the propagation velocity of light is  $c$  w.r.t. its source *at the moment of emission*.

So at the moment light is emitted by an astronomical body and the velocity between that body and earth is  $v$ , this light *at that moment* has the propagation velocity  $c-v$  w.r.t. earth, assuming that  $v$  is in the same direction as the propagation of the light, transmitted in the direction of the earth.

Due to the rotation of the earth around the sun, this  $v$  is a completely different velocity at the moment this astronomical light reaches earth, because the earth has changed his position in its orbit completely. But still the same symbol  $v$  will be used.

As soon as the astronomical light enters the atmosphere it will be called terrestrial light.

### 3 The dragcoefficient of Fresnel

In 1818 Fresnel deduced the mathematical expression for the velocity of light in a moving tangible medium. This expression shows the drag coefficient of Fresnel. He deduced this expression, assuming that the 'medium' ether was necessary for the propagation of light and at the same time being an absolute reference for whatever velocity. Fizeau experimentally proved the correctness of this expression in 1851:

$$c_m' = c_m + v(n^2 - 1)/n^2$$

If, instead of what Fresnel assumed, not the ether is taken as the reference for all mentioned velocities, but the source of the light, then this equation has to be interpreted with the following definitions:

$v$  = the velocity of the medium w.r.t. the source of the light

$n$  = the refractive index of the medium

$c_m = c/n$  the velocity of light w.r.t. its source for  $v=0$

$c$  = the velocity of the light w.r.t. its source in vacuum

$c_m'$  = the velocity of light w.r.t. its source for  $v$  not equal zero

Most likely the expression of Fresnel never has been subject of discussion after the medium ether had been abandoned. So be it. By defining the source as the reference for the velocity of light and for the velocity of the medium, Fresnel's expression can, without any restriction, be maintained.

## 4 Terrestrial light

As soon as the astronomical light enters our atmosphere, the situation as described in the previous paragraph shows up.

The refraction coefficient 'n' however is not uniquely defined, because it starts with a value very close to 1 and it is about 1.0003 near the surface of the earth. But the final velocity of the light is of course determined by the 'n' in the neighbourhood of the earth.

This atmosphere behaves like a moving tangible transparent medium as described in the previous paragraph, with velocity  $\mathbf{v}$  w.r.t. the astronomical body *at the moment of emission of that light*. As mentioned already  $\mathbf{v}$  is completely undefined, not only because of the fact that normally the relative velocity between that body and earth is unknown at the moment of emission, but also due to the fact that normally such light will reach our earth after such a long period of time that it is at a completely different position in its orbit around the sun, compared to its position at the moment of emission of the light. The velocity  $\mathbf{v}$  can directly be applied in the expression of Fresnel.

If we now define  $c_m''$  as the velocity of the terrestrial light w.r.t. the medium, so w.r.t. the atmosphere, then  $c_m''$  is also the velocity of the light w.r.t. earth and thus w.r.t. a receiver on earth.

$$c_m'' = c_m + \mathbf{v}(n^2 - 1)/n^2 - \mathbf{v} = c_m - \mathbf{v}/n^2 \approx c_m - \mathbf{v}$$

Without an atmosphere ( $n=1$ ) this velocity would be:  $c_m'' = c - \mathbf{v}$ .

In case the astronomical light comes from a so-called binary pulsar, for example the Hulse-Taylor, the velocity  $\mathbf{v} = \mathbf{v}_c + \mathbf{v}_s$ , with  $\mathbf{v}_s$  a sinusoidal shaped velocity, created by the orbiting pulsar. The order of magnitude of the orbit period is hours to days. This component creates a sinusoidal Doppler shift in such a light signal, after having been received on earth. This Doppler shift can easily be detected by eliminating the unknown but approximately constant component created by  $\mathbf{v}_c$ . Approximately, because during an orbit period of the pulsar the change in orbital velocity of the earth is negligible.

### Conclusion

One of the reasons to reject the so-called ballistic theory of light is that the detected smoothly varying Doppler shift of so-called binary pulsars cannot be explained by this theory.

This chapter shows the incorrectness of such an argumentation.

## VI The Doppler shift and the Special Theory of Relativity

*Summary - This chapter shows the calculations of the Doppler shift in all possible situations and compares the result of one of these situations with the result as predicted by the STR in this same situation. An astonishing contradiction between this predicted result by the STR and the hypothesis on which the STR is built shows up.*

### 1 Introduction

Four situations are considered:

1. a moving **source and receiver** in a tangible transparent medium with an arbitrary propagation velocity of the signal w.r.t. this medium,
2. a moving **source and receiver** in vacuum with a light signal,
3. a moving **mirror** in a tangible transparent medium with an arbitrary propagation velocity of the signal w.r.t. this medium,
4. a moving **mirror** in vacuum with a light signal.

The content of this chapter is based on the theorem that the propagation velocity of light in vacuum is  $c$ , only w.r.t. its source. The correctness of this theorem is proven in chapter I.

Chapter III emphasizes the incorrectness of the STR from an historical point of view.

The last section shows that the relativistic Doppler shift is also based on the assumption that the velocity of light w.r.t. the receiver is  $c - v$ , with  $v$  the relative velocity between source and receiver. This assumption is in contradiction with the hypothesis on which the STR is built: the velocity of light is  $c$  w.r.t. any reference.

### 2 Moving source and receiver in tangible transparent medium

The consideration hereafter shows the calculation of the Doppler shift in the situation of a moving source that emits an arbitrary single frequency signal through an arbitrary medium. The source is moving w.r.t. that medium and the signal is received by a receiver, also moving w.r.t. that medium. This consideration is helpful in describing and understanding the situation where the signal is replaced by light.

The following variables are defined:

$f_s$  = frequency of the emitted signal

$f_r$  = the frequency of the received signal

$v_s$  = velocity of the source w.r.t. the medium, positive in the propagation direction of the signal

$v_r$  = velocity of a receiver w.r.t. the medium, positive in the propagation direction of the signal

$v$  = velocity of the signal w.r.t. the medium

All velocities are thought on the line source-receiver.

The difference in time between two successive emissions of the same amplitude and the same sign is  $1/f_s = T_s$ . If the first of these two emissions takes place at the moment  $t$ , then the second one takes place at the moment that the first one is at a distance  $vT_s$  w.r.t. the place of the source at time  $t$ .

This second emission takes place in the position  $v_s T_s$  of the source, again w.r.t. the position of the source at time  $t$ .

The wavelength of the, in this situation, compressed signal is  $vT_s - v_s T_s$ .

The related frequency  $f_s'$  is the velocity  $v$  divided by this wavelength:

$$f_s' = v / (vT_s - v_sT_s) = f_s v / (v - v_s) \quad (1)$$

A receiver at rest w.r.t. the medium thus receives  $f_s'$ . The related received wavelength is  $v/f_s'$ .

A receiver moving w.r.t. the medium receives in such a situation a frequency shifted w.r.t.  $f_s'$ .

This frequency is defined above as  $f_r$ . The calculation of this frequency, as function of the defined variables, is as follows.

The geometrical distance between two successive states of the same amplitude and the same sign, given a frequency  $f_s'$ , is equal to the wavelength  $v/f_s'$ , shown in (1).

A receiver with velocity  $v_r$ , positive in the direction of the propagation of the signal, detects the mentioned two successive states during a time period equal to this wavelength divided by  $(v - v_r)$ , resulting in:  $(v/f_s') / (v - v_r)$ . The reciprocal value of this time period is  $f_r$ .

$$f_r = f_s' (v - v_r) / v$$

Given (1):

$$f_r = f_s (v - v_r) / (v - v_s) \quad (2)$$

The Doppler shift thus is:

$$f_r - f_s = f_s (v_s - v_r) / (v - v_s) \quad (3)$$

The expression shows that a certain velocity of the source w.r.t. the medium does not lead to the same frequency shift as when the receiver moves with the same velocity w.r.t. the medium.

For the extreme situation  $v_s = v$ , the received frequency is infinite, while for  $v_r = v$  this frequency is zero, with the remark that the signal will never reach the receiver.

The reason for this asymmetry is that the movement of the source leads to an actual different wavelength in the medium, while the movement of a receiver only results in a change of time periods between two successive equal states of the wave in the receiver.

The expression also shows that whatever  $v$  is, which means whatever the circumstances are, the Doppler shift at the receiver is zero if source and receiver do not move relative each other ( $v_s = v_r$ ).

Therefore it can be concluded that most likely the applied mathematics are correct and the physical interpretations behind them too.

In case of a light signal the velocity  $v$  can be expressed in mathematical terms. In chapter V it is shown that the velocity of light in a medium, with refractive index  $n$ , *w.r.t. its source* equals  $c/n + v(n^2 - 1)/n^2$ , the so called expression of Fresnel.  $v$  is the velocity of the medium *w.r.t. the source*, positive in the propagation direction of the signal. In this chapter  $v_s$  is defined as the velocity of the source *w.r.t. the medium*, positive in the propagation direction of the signal so  $v = -v_s$ . Because  $v$  is defined in section 2 also as the velocity of the signal *w.r.t. the medium*, it can now be presented as:

$$v = c/n - v_s(n^2-1)/n^2 + v_s = c/n + v_s/n^2 \quad (4)$$

For  $n=1$ ,  $v$  being  $c + v_s$  expression (2) becomes:  $f_r = f_s (c + v_s - v_r) / c$  leading to the Doppler shift:

$$f_r - f_s = f_s v_{sr} / c.$$



### 3 Moving source and receiver in vacuum

The Doppler shift in such a situation is represented by (3) in combination with (4) in which  $n=1$ , also calculated at the end of the previous section.

$$\mathbf{f}_r - \mathbf{f}_s = \mathbf{f}_s (\mathbf{v}_s - \mathbf{v}_r) / (\mathbf{c} + \mathbf{v}_s - \mathbf{v}_r) = \mathbf{f}_s (\mathbf{v}_s - \mathbf{v}_r) / \mathbf{c} = \mathbf{f}_s \mathbf{v}_{sr} / \mathbf{c}, \text{ with } \mathbf{v}_{sr} = \mathbf{v}_s - \mathbf{v}_r.$$

This result can also be obtained in the following way.

When a source emits a light signal in vacuum this signal can for two reasons not be compressed or stretched as described in section 2.

Reason one is that there is no medium to be compressed or stretched, reason two is that a velocity can not be defined w.r.t. vacuum.

If an arbitrary reference R would be imagined, w.r.t. which a velocity  $\mathbf{v}_s$  of the source would be defined, than still the process of emission in vacuum will, of course, not change.

That consequently leads to the conclusion that in such a situation the velocity of light is  $\mathbf{c} + \mathbf{v}_s$  w.r.t. R.

This is indeed in contradiction with the STR-hypothesis, but on the other hand only a mathematical tool: the emission process doesn't change, and neither does its propagation velocity w.r.t. the source by imagining such a reference.

Practically the only reference that is left for a possible velocity of the source, is the receiver. It is also the only relevant one, because we want to describe the frequency shift as received by this receiver. So only the relative velocity  $\mathbf{v}_{sr}$ , between source and receiver can finally be relevant.

In such a situation there is still no reason that the emitted frequency  $\mathbf{f}_s$  will be changed during emission. So the wavelength of the signal, arriving at the position of the receiver is  $\mathbf{c} / \mathbf{f}_s$ .

In order to keep as close as possible to the description of the general situation, the relative velocity  $\mathbf{v}_s - \mathbf{v}_r$  is, for the time being, split up in a velocity  $\mathbf{v}_s$  and  $\mathbf{v}_r$  both referenced to that arbitrary reference R, positive in the direction of the propagation of the light.

As mentioned already, the velocity of the light departing from the source is then  $\mathbf{c} + \mathbf{v}_s$  w.r.t. R.

The velocity of the receiver w.r.t. the light signal is  $\mathbf{c} + \mathbf{v}_s - \mathbf{v}_r$ .

The received frequency  $\mathbf{f}_r$  is this velocity divided by the mentioned wavelength  $\mathbf{c} / \mathbf{f}_s$ :

$$\mathbf{f}_r = (\mathbf{c} + \mathbf{v}_s - \mathbf{v}_r) / (\mathbf{c} / \mathbf{f}_s) = \mathbf{f}_s (1 + \mathbf{v}_{sr} / \mathbf{c}), \text{ with } \mathbf{v}_{sr} = \mathbf{v}_s - \mathbf{v}_r.$$

The Doppler shift thus is:

$$\mathbf{f}_r - \mathbf{f}_s = \mathbf{f}_s \mathbf{v}_{sr} / \mathbf{c}.$$

It shows the agreement with the result obtained with the method of calculation shown in section 2.

## 4 Moving mirror in a tangible transparent medium

A mirror has to be considered as a combination of receiver and transmitter, in which the received signal is, more or less immediately, transformed into an emitted signal.

At the moment of emission the mirror thus is a source.

This section will show the calculation of the Doppler shift using the hypothesis that the velocity of light is only  $c$  w.r.t. its source.

This model will be applied below in a (forward) situation that the original source and the mirror both move with their own velocity w.r.t. a medium and that after reflection (backward situation) the original source will be considered as a receiver. The following frequencies are defined:

$f_s$  = frequency of the emitted signal by the original source

$f_m$  = frequency at the moment of arrival at the mirror, in case the source does have the velocity  $v_s$  and the mirror the velocity  $v_m$  w.r.t. the medium

$f_r$  = frequency of the received signal at the position of the original source, after reflection at the mirror, in the same circumstances as described under  $f_m$

$v'_s$  = velocity of the signal w.r.t. the medium, propagating from source to mirror

$v'_m$  = velocity of the signal w.r.t. the medium, propagating from mirror to source

Using formula (2) we directly can write:

$$f_m = f_s (v'_s - v_m) / (v'_s - v_s) \quad \text{with } v'_s = c/n + v_s/n^2 \quad (4a)$$

$$f_r = f_m (v'_m + v_s) / (v'_m + v_m) \quad \text{with } v'_m = c/n - v_m/n^2 \quad (4b)$$

So  $f_r$  is:

$$f_r = f_s \{(v'_s - v_m) / (v'_s - v_s)\} \cdot (v'_m + v_s) / (v'_m + v_m) = f_s (v'_s - v_m) \cdot (v'_m + v_s) / (v'_s - v_s) \cdot (v'_m + v_m) \quad (5)$$

## 5 Moving mirror in vacuum

In vacuum ( $n=1$ ) the velocities  $v'_s = c + v_s$  and  $v'_m = c - v_m$ , see (4a) resp. (4b), have to be applied in (5):

$$f_r = f_s (c + v_s - v_m) \cdot (c - v_m + v_s) / (c + v_s - v_s) \cdot (c - v_m + v_m) = f_s (c + v_s - v_m)^2 / c^2$$

The Doppler shift between the original signal and the signal received back at the original source thus is:

$$f_r - f_s = f_s \{(c + v_{sm})^2 / c^2 - 1\} \quad \text{with } v_{sm} = v_s - v_m$$

Written as:

$$f_r - f_s = 2f_s v_{sm} / c + f_s (v_{sm} / c)^2$$

this shows that, even in astronomical situations, the Doppler shift is about  $2f_s v_{sm} / c$ , because  $f_s (v_{sm} / c)^2$  is negligible w.r.t.  $2f_s v_{sm} / c$ .

The result agrees with reality, again emphasizing that the theory applied in this chapter is correct.

## 6 Relation with the Special Theory of Relativity

The just found result will be compared with the result that would be obtained if the STR-hypothesis would be applied: light moves in vacuum with velocity  $c$ , independent of whatever reference.

At the moment of emission the STR-hypothesis and the theorem that the velocity of light in vacuum is only  $c$  w.r.t. its source, agree in two senses: the one is that light in vacuum does have the velocity  $c$  w.r.t. its source, the other is that during emission in vacuum a frequency change cannot be created.

In case of a tangible medium only a very small frequency change, proportional to the velocity of the source w.r.t. the medium, takes place.

But arriving at the receiver, thus with the original frequency of the source, this velocity is  $c$  w.r.t. the receiver in case of the STR-hypothesis, whatever the velocity of this receiver w.r.t. the source might be. So the receiver will not create a frequency change, in view of the process as described above.

Notwithstanding this contradiction with reality the frequency change based on the STR considerations, is formulated as:

$$f_r = f_s \sqrt{(c + v_{sr})} / \sqrt{(c - v_{sr})}$$

Elaborating this formula, with, in the first instance, approximating  $1/(c-v_{sr})$  by  $(1+v_{sr}/c)/c$  results in:

$$f_r \sim f_s (1 + v_{sr}/c)$$

This is the same result as presented in section 2 and 3.

Remarkable is that this formula also shows the velocity of light to be not equal to  $c$  in such a situation, which is *exclusively excluded* in the STR! It even shows the same property of light as proven in chapter I: the velocity of light is  $c+v$ , resp.  $c-v$  w.r.t. a reference that is moving with velocity  $v$  w.r.t. the source of the light.

N.B. If light would not have that property, it would not be possible to detect a change in the frequency of the emitted light in such a situation!

### Conclusion

The phenomenon “Doppler shift” as prescribed by the Special Theory of Relativity proves that the result is in contradiction with the hypothesis on which this theory is built. The result even emphasizes the theorem, as proven in chapter I, that the velocity of light is only  $c$  with respect to its source.

## VII Conventional calculation of potential energy fundamentally incorrect

*Summary - In this chapter it is proven that the conventional calculation of gravitational and electrostatic potential energy leads to absurd consequences for Bohr's atomic model. The presented alternative calculation fully eliminates these consequences.*

### 1 Conventional versus alternative calculation of potential energy

Potential energy is defined as  $E_p = \int F(r) dr$ , with  $F(r)$  a force along the path  $r$ , of which the boundaries have yet to be defined.

This so-called work function is also used to calculate the electrical, not to confuse with electrostatic, potential energy, but its elaboration for that purpose bears no resemblance to the elaboration hereafter.

#### 1.1 Conventional calculation

Reference [1] calculates that, given a distance  $d$  between masses  $M$  and  $m$ , their mutual *conventional* potential energy  $E_{PC} = -GMm/d$ . The negative sign is explained as follows: "The negative sign follows the convention that work is gained from a loss of potential energy." It can be deduced that the result has been obtained by moving the masses further away from each other, starting the variable  $r$  in  $F(r)$  at the mutual distance  $d$  and ending at  $r \rightarrow \infty$ .

#### 1.2 Alternative calculation

The smallest mutual distance  $r$  between these two masses, with radii  $r_M$  resp.  $r_m$ , is  $r_s = r_M + r_m$ . The *alternative* calculation of their mutual potential energy is to move them away from each other, starting at  $r = r_s$  until  $r = d$ , and assuming a *positive* force  $F(r)$ . The result is:

$$E_{PA} = \int_{r_s}^d GMm/r^2 dr = GMm (1/r_s - 1/d)$$

This expression has the following remarkable property compared to the conventional one:  $E_{PA}$  is only equal to  $E_{PC}$ , regarding its absolute value as well as its sign, if  $r_s \gg d$ . Worth to investigate further.

From now on only the situations  $r_m \ll r_M$  will be considered, so  $r_s \sim r_M$ .

The expression for the alternative energy also shows that for  $d \gg r_M$ ,  $E_{PA} = GMm/r_M$ . At first sight a surprising result, because the distance  $d$  doesn't play any role in it, while the conventional calculation leads to a potential energy approaching to zero for  $d \gg r_M$ . The explanation is as follows.

An object at distance  $d \gg r_M$  has the potential to be transformed completely into kinetic energy, just by "releasing" it there. Coming back at distance  $r_M$  this kinetic energy is  $\frac{1}{2}mv_{EM}^2$ . Being equal to  $GMm/r_M$ ,  $v_{EM} = \sqrt{2GM/r_M}$ , the so-called escape velocity of mass  $M$  with radius  $r_M$ .

The formal meaning of the escape velocity is that if an arbitrary mass  $m$  is shot into space with this velocity, it will become out of the gravitational influence of mass  $M$  at distance  $d \gg r_M$ . The reverse way of calculating this escape velocity is to start at  $r_M$  with an unknown kinetic energy of  $\frac{1}{2}mv^2$ . The final potential energy is  $GMm/r_M = \frac{1}{2}mv^2$ , so indeed  $v = \sqrt{2GM/r_M}$ .

The well-known expression for the potential energy of an object w.r.t. earth is  $mgh$ , with  $h$  the distance w.r.t. earth's *surface*, so in terms of  $d$  and  $r_M$ :  $d = r_M + h$ . The restriction is:  $h \ll r_M$ . Applying this in the expression of the alternative potential energy results in:

$$E_{PA} = GMm \{1/r_M - 1/(r_M+h)\} \sim GMmh/r_M^2 = mgh, \text{ with } g = GM/r_M^2 \text{ ( } g \text{ is the free-fall acceleration).}$$

If  $h \gg r_M$  the outcome is the, in the mean time well known, expression  $GMm/r_M$ .

## 2 Conventional and alternative potential energy in circular orbital systems

The force between the two objects in a circular orbital system, from now on shortly orbital system, is in general terms  $F(r) = C/r^2$  and known under the name centripetal force.

Taking the orbital radius  $r_o$  as the distance in the calculation of the conventional resp. alternative potential energy, results in:  $E_{PC} = -C/r_o$  resp.  $E_{PA} = C/r_M$  for  $r_o \gg r_M$  as shown above.

The kinetic energy  $E_K$  of an orbiting mass  $m$  with orbital velocity  $v_o$  is  $\frac{1}{2}mv_o^2$ . The centrifugal force is  $mv_o^2/r_o$  and the centripetal force  $C/r_o^2$ . These forces are by definition equal in an orbital system. So it follows from  $mv_o^2/r_o = C/r_o^2$  that  $\frac{1}{2}mv_o^2 = \frac{1}{2}C/r_o = -\frac{1}{2}E_{PC}$ , resulting in  $E_{PC} = -2E_K$ .

An absurd outcome, at least regarding the sign.

Applying the alternative calculation of the potential energy in such a situation ( $E_{PA} = C/r_M$ ) shows that this potential energy doesn't have a meaningful relation at all with the kinetic energy  $E_K = C/2r_o$ . The reason is the following.

In an orbital system the centripetal and centrifugal force are continuously in balance. Otherwise the orbiting object would escape out of its orbit in whatever direction. Due to this balance of forces the potential energy does not play any role anymore in an orbital system.

## 3 Intrinsic atomic energy

The Protium atom is as an example of an electrostatic orbital system. Coincidentally  $r_{proton} \gg r_{electron}$  and  $r_o \gg r_{proton}$ , but not relevant, as proven in section 2. The total energy  $E_K + E_P$  of a gravitational and electrostatic orbital system, applying the conventional calculation, is  $-E_K$ , given the relation  $E_P = -2E_K$ . Again an absurd consequence leading to the description below copied from [2]. The wrong words have been scratched out and the correct words, obeying the alternative calculation, written behind them.

“In atoms with a single electron ..., the energy of an orbital ... is determined exclusively by  $n$ . The  $n=1$  orbital has the ~~lowest~~ *highest* possible energy in the atom. Each successively higher value of  $n$  has a ~~higher~~ *lower* level of energy, but the difference decreases as  $n$  increases \*. For high  $n$ , the level of energy becomes so ~~high~~ *low* that the electron can easily escape from the atom.”

\* The examples below shows the correctness of this statement by means of the Rydberg expression:  $E = hf = hc * R_\infty (1/n_1^2 - 1/n_2^2)$ .

$n_1$	$n_2$	$1/n_1^2 - 1/n_2^2$
1	2	0,75
5	6	0,012
10	11	0,0017

## Conclusions

- 1 The conventional calculation of potential energy leads to the wrong result  $E_{PC} = -GMm/d$  in case of mass  $M$  and  $m$  at mutual distance  $d$  of their centres. In the alternative calculation of the potential energy  $E_{PA} = GMm (1/r_s - 1/d)$ , with  $r_s$  the sum of the radii of the masses.
- 2 Applying the conventional calculation the absurd consequence is that the sum of the intrinsic potential and kinetic energy of an atom is negative, resulting in an equivalent absurd consequence that the smallest orbit contains the lowest energy, as a result of that negative sign!
- 3 The alternative calculation leads to the conclusion that the intrinsic energy of a gravitational and electrostatic orbital system is only determined by the kinetic energy of the orbiting object.

## References

- [1] [https://en.wikipedia.org/wiki/Potential\\_energy](https://en.wikipedia.org/wiki/Potential_energy)
- [2] [http://en.wikipedia.org/wiki/Atomic\\_orbital](http://en.wikipedia.org/wiki/Atomic_orbital)

## VIII Why a photon is not a particle

*Summary - The variables and parameters of the presented model for the generation of an arbitrary photon fit like the pieces of a jigsaw puzzle and therefore justify the conclusion that the model eliminates the wave-particle duality of the photon by explicitly excluding the possibility that it can be a (massless) particle too. On top of that it has been proven that the energy of the photon is directly delivered by the magnetic energy of the atom, as created by the orbiting electron(s).*

### 1 Introduction

Considering a photon as an (extremely) short pulse with an electromagnetic wave as carrier, this eliminates the so-called wave-particle duality. The article shows how the origin of such a pulse can be explained by applying Ampère's and Faraday's law in Bohr's atomic model. The Rydberg formula shows that  $E=hf$  is a correct relation between energy and frequency of photons, but also that it is only valid for photons. The pulse lengths of the photons have been calculated by equating that energy with their electromagnetic energy. The pulse length is the number of EM waves in the pulse, times the wavelength in seconds.

### 2 Bohr's atomic model

In Bohr's atomic model, in case of a stable atom, an equal number of electrons revolve around the nucleus, as there are protons in this nucleus. These electrons can rotate in orbits with different distances with respect to the nucleus. These distances are generally accepted as being discreet. In other words: an electron will never orbit in between determined circles.

The here chosen concept is that a photon is emitted if an electron jumps out of an inner orbit into an outer orbit and not the other way round, as will be explained in section 4.

### 3 Forces holding the electron in its orbit

An electron is held in its orbit by three forces:

- the centrifugal force trying to jump the electron out of its orbit.  $F_{cf}$
- the centripetal Coulomb force between nucleus and electron  $F_C$
- the centripetal gravitational force between nucleus and electron  $F_G$

with:

r	radius of the orbit of the electron		m
v	velocity of the electron along its orbit		m/s
$\omega$	radial velocity of the electron (v/r)		rad/s
Z	atom number		
m	mass of the electron	$9.1 \cdot 10^{-31}$	kg
$m_p$	mass of proton	$1.7 \cdot 10^{-27}$	kg
$m_n$	mass of the nucleus	$2 Z m_p$	kg
G	gravitational constant	$6.7 \cdot 10^{-11}$	$\text{Nm}^2\text{kg}^{-2}$
$\kappa$	Coulomb's constant $(1/4\pi\epsilon_0)$	$9.0 \cdot 10^9$	$\text{Nm}^2\text{C}^{-2}$
q	electric charge of the electron/proton	$1.6 \cdot 10^{-19}$	C

The mathematical descriptions of the three mentioned forces are respectively:

$$F_{cf} = m\omega^2 r = mv^2/r \qquad F_C = \kappa Zq^2/r^2 \qquad F_G = Gm_n m/r^2$$

Remarks:

- r has the discreet values  $n^2 a_0 / Z$ , with  $a_0$  the so called Bohr radius ( $n=1, 2, 3, \dots$ )
- The mass of a proton is about equal to the mass of a neutron.
- $F_G \sim 10^{-67} Z/r^2$  and  $F_C \sim 10^{-28} Z/r^2$ , showing that  $F_G$  is completely negligible.

As a result, the electron is held in its orbit by  $F_{cf} = F_C$ .

So:  $mv^2/r = \kappa Zq^2/r^2$

from which it follows that:  $v = (\kappa Zq^2/mr)^{1/2}$

## 4 The basic idea behind the generation of a photon

*The fundamental part of the investigated model is the assumption that the orbit of an electron around the nucleus of an atom is equivalent to a circular shaped electric current, creating a magnetic field.*

Suppose the “round trip” of an electron is  $t$  seconds and its electric charge is represented by the symbol  $q$ . Then the first approximation of the mean electric current is  $q/t = i$ . The mentioned “round trip” is equal to  $2\pi r/v$ , with  $r$  the radius of the orbit of the electron and  $v$  the velocity along that orbit. So  $i = qv/2\pi r$ . Such an electric current causes a static magnetic field  $H$ , perpendicular to the plane of the orbit. *Only in the centre of the orbit this field yields:*

$$H = i/2r = qv/4\pi r^2 = q^2(\kappa Z/m)^{1/2}/4\pi r^{2.5}$$

As soon as the electron jumps out of its orbit,  $r$  changes, so the strength of this magnetic field changes. And a change of a magnetic field causes a change of an electric field.

*A source of an electromagnetic wave has been created!*

The purpose of this analysis is to investigate whether this idea makes sense or not in relation to the available information about photons.

## 5 The kinetic and potential energy of an orbiting electron

The phenomenon potential energy is fully eliminated in an orbiting system by the fact that the centripetal and centrifugal forces, resulting from a perfect circular orbiting electron, are continuously in balance with each other. The only phenomenon that really contains energy therefore is its kinetic energy.

The kinetic energy  $E_k$  of an orbiting electron equals  $\frac{1}{2}mv^2$ . This type of energy is, as the expression shows, by definition positive. Incorporating potential energy leads to the most absurd statements regarding the energy levels in an atom, as shown in reference [1].

The wrong words have been scratched out and the correct ones have been written behind them in italics.

### **Orbital energy**

In atoms with a single electron (hydrogen-like atoms), the energy of an orbital (and, consequently, of any electrons in the orbital) is determined exclusively by  $n$ . The  $n=1$  orbital has the ~~lowest~~ *highest* possible energy in the atom. Each successively higher value of  $n$  has a ~~higher~~ *lower* level of energy, but the difference decreases as  $n$  increases. For high  $n$ , the level of energy becomes so ~~high~~ *low* that the electron can easily escape from the atom.

From  $E_k = \frac{1}{2}mv^2$ , with  $v^2 = \kappa Zq^2/mr$ , it follows that  $E_k = \frac{1}{2}\kappa Zq^2/r$ , emphasizing the conclusion that the smaller the orbit, the higher the energy state of the atom.

## 6 Background of the Rydberg expression

Citations from Wikipedia:

*“The Planck constant  $h$  has been introduced to express the relation between frequency  $f$  and energy  $E$  for a light quantum (photon) as:  $E=hf$ .”*

*“The Planck constant was first described as the proportionality constant between the energy ( $E$ ) of a photon and the frequency ( $f$ ) of its associated electromagnetic wave.”*

The formula  $E=hf$  is a non-physical equation, because it suggests that the energy of a photon is proportional to the frequency of its “associated electromagnetic wave”. It is well known that this can, physically speaking, not be true. Only the amplitude of the electromagnetic wave can be related to its power, thus to its energy. However measurements carried out by Rydberg have shown that this relation is found, but exclusively restricted to photons.

It is generally accepted that the orbits of an electron are discrete. However, up to now nothing in Bohr’s model forces us to such a hypothesis. For whatever radius  $r$ , the balance between the Coulomb and the centrifugal force is, by definition, perfect. That would also mean that in principle an arbitrary small orbit radius would be possible. Section 5 shows that the total energy of the orbiting electron would increase to infinite if the radius of the orbit would decrease to zero. This will not happen because an external source with an infinite energy would be necessary to reach such a situation.

But still the question why an electron is only orbiting at discrete distances to the nucleus is not answered.

The discrete radii are mathematically represented by  $r_n = n^2 a_0/Z$ , with  $n$  is an integer.

The radius  $a_0$  is the so-called Bohr radius, the smallest in the neutral hydrogen atom.

The mathematical expression for  $a_0$  is found as follows.

The idea behind the quantitative presentation of the discrete radii is based on the assumption, for whatever reason, that the angular momentum  $mvr_n$  of the electron is quantized, expressed as:

$$mvr_n = nb/2\pi \quad \text{so:} \quad mv^2r_n = (nb/2\pi)v \quad \text{and} \quad v = (nb/2\pi)/mr_n$$

From  $F_{cf} = mv^2/r_n = F_C = \kappa Zq^2/r_n^2$  it follows that:

$$mv^2r_n = \kappa Zq^2 \quad \text{also equal to} \quad (nb/2\pi)v$$

Given  $v = (nb/2\pi)/mr_n$  it follows that :

$$\kappa Zq^2 = (nb/2\pi)^2/mr_n \quad \text{so:}$$

$$r_n = n^2b^2/(4\pi^2\kappa Zq^2m)$$

$r_n$  is defined as  $a_0$  for  $n=1$  and  $Z=1$ , so:

$$a_0 = b^2/(4\pi^2\kappa q^2m)$$

The *positive* difference in kinetic energy of the electron orbiting in  $n_1$  respectively  $n_2$ , is represented by:

$$\Delta E_{kn} = \frac{1}{2}m(v_1^2 - v_2^2), \quad \text{with:} \quad v_i^2 = \kappa Zq^2/mr_{ni} \quad \text{resulting in:}$$

$$\Delta E_{kn} = (\kappa Zq^2/2) \cdot (1/r_{n1} - 1/r_{n2}) = (\kappa Zq^2/2a_0/Z) \cdot (1/n_1^2 - 1/n_2^2)$$



Applying the expression for  $a_0$ :

$$\Delta E_{kn} = \left\{ \kappa Z^2 q^2 / (2b^2 / (4\pi^2 \kappa q^2 m)) \right\} \cdot (1/n_1^2 - 1/n_2^2)$$

$$\Delta E_{kn} = b^{-2} \kappa^2 Z^2 q^4 2\pi^2 m \cdot (1/n_1^2 - 1/n_2^2) \quad \kappa = 1/4\pi\epsilon_0 \quad \text{so:}$$

$$\Delta E_{kn} = Z^2 m q^4 2\pi^2 / (b^2 \cdot 4\pi\epsilon_0 \cdot 4\pi\epsilon_0) \cdot (1/n_1^2 - 1/n_2^2)$$

$$\Delta E_{kn} = b \cdot c \cdot Z^2 m q^4 / (8\epsilon_0^2 b^3 c) \cdot (1/n_1^2 - 1/n_2^2)$$

$$\Delta E_{kn} = b \cdot c \cdot Z^2 m q^4 / (8\epsilon_0^2 b^3 c) \cdot (1/n_1^2 - 1/n_2^2) = b \cdot c \cdot Z^2 \cdot R (1/n_1^2 - 1/n_2^2)$$

With  $R = m q^4 / 8\epsilon_0^2 b^3 c$ , being the so called Rydberg constant, with the following values:

$m$	mass of the electron	$9.1 \cdot 10^{-31}$	kg
$q$	electric charge of the electron	$1.6 \cdot 10^{-19}$	C
$\epsilon_0$	dielectric permittivity	$8.854 \cdot 10^{-12}$	As/Vm
$b$	Planck's constant	$6.626 \cdot 10^{-34}$	VAs <sup>2</sup>
$c$	velocity of light in vacuum	$2.999 \cdot 10^8$	m/s
$R$	Rydberg's constant	$1.097 \cdot 10^7$	m <sup>-1</sup>

For  $Z=1$  the result is the well known expression:

$$1/\lambda = R(1/n_1^2 - 1/n_2^2)$$

Because

$$c/\lambda = f \quad \text{it follows that for } Z=1:$$

$$f = c \cdot R(1/n_1^2 - 1/n_2^2) = \Delta E_{kn} / b \quad \text{leading to the expression for arbitrary } Z:$$

$$\Delta E_{kn} = hf = b \cdot c \cdot Z^2 \cdot R (1/n_1^2 - 1/n_2^2)$$

This expression shows that theoretically  $n_i$  doesn't need to be an integer, but Rydberg did measure so.

This loss of *mechanical* energy cannot directly be converted into the energy of the EM-wave of the photon. This is solved by the fact that the orbiting electron creates a magnetic field. The change of this field directly causes the generation of this EM-wave. So a decrease of the kinetic energy is converted directly into a decrease of the magnetic energy, representative for the energy of the EM-wave. This energy is found by multiplying the power of the EM-wave with the time during which this wave is emitted. This time is called the pulse length of the photon.

## 7 Calculation of the pulse length of the photon

Given the basic idea behind the generation of a photon as described in the previous section, the magnetic and electric fields  $A_H$  and  $A_E$  of the emitted EM-field will be described by a sinusoidal shaped function:  $A_H(t) = A_H \cos(\omega t)$  resp.  $A_E(t) = A_E \cos(\omega t)$ , with  $A_E = Z_v \cdot A_H$  and  $Z_v$  the so called characteristic impedance for vacuum.  $Z_v = (\mu_0/\epsilon_0)^{1/2} = 377 \Omega$ .

The power density of the related EM-field is:  $P_d = A_E/\sqrt{2} \cdot A_H/\sqrt{2} = Z_v A_H^2/2 \quad \text{VA/m}^2$

The generation of this EM-field will stop at the moment the electron orbits at a larger radius with the related velocity. The time between the start and the end of this process has been called the pulse length, so in terms of seconds.

In the radar technic, where such a pulse is generated with mutually independent power, pulse length and frequency, this variable is called pulse width.

The equation  $E = hf$  thus is certainly not applicable in such a situation. In order to get a first impression of the pulse length of the photon the situation will be considered that the orbiting electron jumps out of the smallest orbit  $r_1$  in a  $^1_1\text{H}$  atom to an orbit which a much larger radius, or out of the atom. In such a situation the amplitude  $A_H$  equals the static magnetic field strength as shown in section 4:  $H_{i(\text{initial})} = q^2(\kappa/m)^{1/2}/4\pi r_1^{2.5}$ , because the only cause of this field is the only electron orbiting the proton in the atom's nucleus. So, after such a jump no static magnetic field at all is left in the atom. This approach has lead to the description of  $A_H(t)$  as  $A_H \cos(\omega t)$ , instead of  $A_H \sin(\omega t)$ , but is further not of any importance. The final result is an EM-field that propagates with velocity  $c$ , *relative to the atom*.

N.B. *Not relative to whatever reference, as described in chapter III, section 3!*

It is assumed that the surface, related to this power density, is constrained by the orbit of the electron from which it jumps ( $\pi r_1^2$ ), so equating  $A_H$  with  $H_i$ , the power  $P$  of the photon is:

$$P = (Z_v q^4 \kappa / 32 \pi m) \cdot r_1^{-3} \quad \text{W}$$

This power multiplied by the pulse length of the photon in seconds, abbreviated as  $\text{plsl}$ , also results in an expression for the EM energy of the photon.

$$E_{EM} = \text{plsl} \cdot (Z_v q^4 \kappa / 32 \pi m) \cdot r_1^{-3} \quad \text{J}$$

This energy equals the kinetic energy  $E_{kin} = \frac{1}{2} m v_1^2$ , with  $v_1^2 = q^2 \kappa / m r_1$

So the pulse length follows from  $E_{EM} = E_{kin} \quad \text{plsl} = 16 \pi m q^{-2} Z_v^{-1} \cdot r^2 \quad \text{s}$

In the general situation an electron jumps from orbit  $r_i$  to  $r_j$  in an atom with atomic number  $Z$ .

In such an atom holds:  $v_i^2 = q^2 \kappa Z / m r_i$ .

The related power of the EM-field *decreases* from

$$(Z_v q^4 \kappa / 32 \pi m) \cdot r_i^{-3}$$

to

$$(Z_v q^4 \kappa / 32 \pi m) \cdot r_j^{-3}$$

so  $\Delta P$  power of the EM field is

$$\Delta P = (Z_v q^4 \kappa Z / 32 \pi m) \cdot (r_i^{-3} - r_j^{-3})$$

$$\Delta P = (Z_v q^4 \kappa Z^4 / 32 \pi m a_0^3) \cdot (n_i^{-6} - n_j^{-6})$$

$\Delta$  energy of the photon is  $\Delta E = \text{plsl} \cdot \Delta P$

$\Delta$  energy equals the  $\Delta$  kinetic energy  $\Delta E = \frac{1}{2}q^2\kappa Z \cdot (r_i^{-1} - r_j^{-1})$

$$\Delta E = \frac{1}{2}q^2\kappa Z^2/a_0 \cdot (n_i^{-2} - n_j^{-2})$$

As a result:  $\text{plsl} = 16\pi m q^{-2} Z v^{-1} \cdot (r_i^{-1} - r_j^{-1}) / (r_i^{-3} - r_j^{-3})$

$$\text{plsl} = 16\pi m q^{-2} Z v^{-1} (a_0/Z)^2 \cdot (n_i^{-2} - n_j^{-2}) / (n_i^{-6} - n_j^{-6})$$

An interesting variable is  $\text{plsl}/T$ , with  $T$  the period time of the frequency of the EM-field, so  $1/f$ . The variable shows the number of periods in a photon.  $T$  can also be written as  $h/\Delta E$ , given  $\Delta E = hf$ , so the expression for  $T$ , following from  $\Delta E$ , is:

$$T = (2h/q^2\kappa Z) \cdot r_i r_j / (r_j - r_i)$$

$$T = (2h a_0 / q^2 \kappa Z^2) \cdot n_i^2 n_j^2 / (n_i^2 - n_j^2)$$

$$\text{plsl}/T = 8\pi m (h Z v)^{-1} \kappa (r_i - r_j)^2 / \{r_i^2 r_j^2 (r_i^{-3} - r_j^{-3})\}$$

$$\text{plsl}/T = 8\pi m (h Z v)^{-1} \kappa a_0 (n_i^2 - n_j^2)^2 / (n_i^{-6} - n_j^{-6})$$

The expressions in  $n_i$  and  $n_j$  are obtained by applying  $r_n = n^2 a_0 / Z$ .

The expression for  $\text{plsl}/T$  shows that it is only dependent of the number of the orbit from where the electron jumps to the number of the orbit where it arrives *and independent of Z!*

See the Table below. A surprising result is that the higher the frequency, the fewer of these periods exist in the pulse.

n	f	plsl	f	plsl	f	plsl	plsl/T
1	<b>3,3E+15</b>	<b>1,3E-14</b>	<b>1,8E+19</b>	<b>1,3E-14</b>	<b>4,6E+19</b>	<b>1,3E-14</b>	<b>44</b>
2	2,5E+15	1,0E-14	1,4E+19	1,8E-18	3,4E+19	7,3E-19	25
3	4,6E+14	1,3E-13	2,5E+18	2,4E-17	6,4E+18	9,3E-18	59
4	1,6E+14	5,7E-13	8,8E+17	1,0E-16	2,2E+18	4,1E-17	91
5	7,4E+13	1,7E-12	4,1E+17	3,0E-16	1,0E+18	1,2E-16	123
6	4,0E+13	3,8E-12	2,2E+17	7,0E-16	5,6E+17	2,7E-16	153
7	2,4E+13	7,6E-12	1,3E+17	1,4E-15	3,4E+17	5,4E-16	183
8	1,6E+13	1,4E-11	8,6E+16	2,5E-15	2,2E+17	9,7E-16	213
9	1,1E+13	2,2E-11	5,9E+16	4,1E-15	1,5E+17	1,6E-15	243
10	7,7E+12	3,5E-11	4,2E+16	6,4E-15	1,1E+17	2,5E-15	272

Table 1: Frequencies and pulse lengths as function of  $n$  and  $Z$  and  $\text{plsl}/T$  as function of  $n$

Röntgen/X radiation, produced by Tungsten ( $Z = 74$ ), shows frequencies from  $10^{16}$  to  $10^{19}$  Hz. Copied from [2]: “X-radiation is a penetrating form of high-energy electromagnetic radiation. ....Most X-rays show frequencies in the range  $3 \times 10^{16}$  Hz to  $3 \times 10^{19}$  Hz”

If  $n_j \gg n_i$ :  $\text{plsl}/T = 8\pi m (h Z v)^{-1} \kappa a_0 n_i^2$

For all smallest radii  $n_i = 1$ , so  $\text{plsl}/T = 8\pi m (h Z v)^{-1} \kappa a_0$

The **blue values** in Table 1 for  $n = 1$  are related to the last mentioned situation and play a crucial role in the alternative model of the neutron, emitting so-called nuclear photons, described in chapter XXIII.

## Conclusions

The study has proven that the generation of a photon can be explained by starting with considering an orbiting electron in an atom as a circular electric current.

This current causes a magnetic field, perpendicular to the plane of the orbit and enclosed by the orbit of the electron.

As soon as the electron jumps to a more outer orbit, this magnetic field decreases rapidly and causes through this an electric field. A source of an EM field has been created.

Calculations, carried out on this model, proved that this principle indeed works, but above all it also shows the mathematical expression for the length, expressed in seconds, of the photon.

The model confirms that the energy of the photon equals the kinetic energy of the electron in the orbit where it came from, minus this kinetic energy in the orbit where it jumped to, but this difference in kinetic energy is not the direct source of the energy of the photon. The direct source is the magnetic energy of the atom as created by the orbiting electron(s).

At the end of the day it has to be concluded that this model eliminates the wave-particle duality: no whatever (magic) particle plays whatever role in this model.

Einstein wrote about this duality the following;

*"It seems as though we must use sometimes the one theory and sometimes the other, while at times we may use either. We are faced with a new kind of difficulty. We have two contradictory pictures of reality; separately neither of them fully explains the phenomena of light, but together they do".*

My words:

Nature doesn't deal with dualities, paradoxes or contradictions.

Judgments like these are created by mankind, not understanding a certain phenomenon.

Physical science should not accept these kinds of judgements.

## References

- [1] [http://en.wikipedia.org/wiki/Atomic\\_orbital](http://en.wikipedia.org/wiki/Atomic_orbital)
- [2] <https://en.wikipedia.org/wiki/X-ray>

## IX Matter waves: a fable

*Summary -This chapter criticises the phenomenon “wave-like-behaviour” of matter and shows that the Davisson-Germer experiment, considered as the validation of De Broglie’s hypothesis, can be interpreted in another way too.*

### 1 Introduction

In chapter VIII: ‘Why a photon is not a particle’ it has been argued that the generation of a photon is caused by a changing orbit of an electron around the nucleus of an atom, based on the principle of a changing magnetic field, resulting in an EM-source. A somewhat similar approach can also be applied in the situation of a linearly accelerated electron, as used in the Davisson-Germer experiment.

### 2 De Broglie’s hypothesis

The question is: what is physically meant by matter wave?

In ref.[1] the following description is presented:

*“All matter can exhibit wave-like behaviour. For example a beam of electrons can be diffracted just like a beam of light or a water wave. Matter waves are a central part of the theory of quantum mechanics, being an example of wave–particle duality. The concept that matter behaves like a wave is also referred to as the de Broglie hypothesis due to having been proposed by Louis de Broglie in 1924. Matter waves are often referred to as De Broglie waves.*

*The De Broglie wavelength is the wavelength,  $\lambda$ , associated with a **massive** particle and is related to its momentum  $p$  through the Planck constant  $h$ :  $\lambda = h/p$ .*

*Wave-like behaviour of matter was first experimentally demonstrated in the Davisson–Germer experiment using electrons, and it has also been confirmed for other elementary particles, neutral atoms and even molecules. The wave-like behaviour of matter is crucial to the modern theory of atomic structure and particle physics.”*

Remarks:

- The word “massive” is most likely meant as ‘having a mass’ because the momentum  $p$  of a particle, with mass  $m$ , is defined as  $p=mv$ , with  $v$  being the velocity of the particle. (‘Massive’ normally means ‘gigantic!’)
- The conception “matter-waves” is in first instance and fundamentally meant to belong to pure, so uncharged, matter, given the relation  $\lambda = h/mv$ . However the Davisson–Germer experiment, using electrons, is put forward as the experiment proving the correctness of the original relation of De Broglie. Further on it will be shown that this experiment can be interpreted in another way too, leading to the conclusion that this experiment does not prove that matter-waves exist.
- If De Broglie’s hypothesis would be valid in case of an uncharged particle  $m$  with velocity  $v$ , then the fundamental question is: what kind of oscillations, with the frequency  $mv/h$ , are meant? The impression is given that no one ever answered this question and no motivation has been found to read all the given references for the following reason.
- Imagine this mass  $m$  in vacuum, for example in the universe, then the question is: with respect to what reference is the velocity  $v$  of this mass meant? Choosing different references means that the frequency of the matter waves, exhibited by this mass, depends on the chosen reference. Not a likely physical property and, on top of that, in contradiction with the Galilean’s Principle of Relativity (GPR), because the *constant* velocity  $v$  would show “matter-wave-frequencies” that would depend on this  $v$ . The GPR prescribes that all physical laws are the same in all inertial systems, so *independent* of their *constant* velocity. See chapter I for more details.

Conclusion: it is, to state it softly, very unlikely that matter waves do exist.

### 3 The Davisson-Germer experiment

This experiment is carried out with linearly accelerated electrons, as for example written in ref. [2]:  
“Electrons from a heated filament were accelerated by a voltage and allowed to strike the surface of nickel metal.”

The remarkable thing about this experiment is that the electrons are accelerated, showing a contradiction with De Broglie’s hypothesis, in which the particles are meant to have a constant velocity.

As a result there is no relation between De Broglie’s hypothesis and the circumstances of this experiment and consequently this experiment cannot be used to claim the validity of De Broglie hypothesis.

What might happen in this experiment that would exhibit a wave and what kind of wave might that be?

An electron moving along a straight line is equivalent to an electric current of the same shape. Such a current causes a circular shaped magnetic field around this current with a constant strength.

When this electron will be accelerated, like in a Scanning Electron Microscope, the strength of the equivalent electric current will change as function of time. As a result the strength of the mentioned circular magnetic field will also change as a function of time.

Just like as in the model of the generation of a photon as shown in chapter VIII: an EM-source has been created.

In this case an EM-source with likely a circular polarization!

#### Conclusions

- Matter waves are not defined in a physical way.
- It is most unlikely that matter waves exist, because they contradict the PGR.
- The Davisson-Germer experiment does not necessarily prove the validity of De Broglie’s hypothesis. It can be interpreted in another way too.

#### Encore

De Broglie’s hypothesis was supported by Einstein. Just like Einstein must have missed the crucial importance of the Galilean’s Principle of Relativity formulating his hypothesis about the velocity of light, he obviously did so too judging De Broglie’s hypothesis.

#### References

- [1] [https://en.wikipedia.org/wiki/Matter\\_wave](https://en.wikipedia.org/wiki/Matter_wave)  
[2] <http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/davger2.html>

## X Gravitational waves: a fable

*Summary - This chapter very briefly criticises the phenomenon “gravitational waves” and shows why this concept is mere fantasy, just like the concepts: space-time, black holes and matter waves.*

### 1 Introduction

The combined web site of Hanford and Livingston Observatory describes the start of the LIGO (Laser Interferometer Gravitational-Wave Observatory), that is supported by the National Science Foundation and operated by Caltech and MIT, as follows:

*“The Newest Search for Gravitational Waves has Begun*

*News Release • September 18, 2015*

*On, Friday, September 18th 2015, the first official 'observing run' (O1) of LIGO's advanced detectors in Hanford WA and Livingston LA quietly began when the clock struck 8 a.m. Pacific time. While this date marks the official start of data collection, both interferometers have been operating in engineering mode collecting data for some weeks already as technicians, scientists, and engineers worked to refine the instrument to prepare it for official data-collection duties. What IS different about today is the scope of the search for gravitational waves. Today, the broader astronomical community has been added to the team. From now on, LIGO will be able to notify any number of 74 astronomical observatories around the world who have agreed to, at a moment's notice, point their telescopes to the sky in search of light signals corresponding to possible gravitational wave detections.”*

In order to gratify National Science Foundation as soon as possible LIGO staff seemingly decided to show already on the 11<sup>th</sup> of February 2016 world wide that they detected gravitational waves.

### 2 Misleading propaganda

The phenomena: space-time, black holes, matter waves and gravitational waves are direct consequences of the Special Theory of Relativity.

In chapter I it is proven that this theory is most fundamentally wrong.

So the question now is: what did the “technicians, scientists, and engineers” really measure?

Certainly not gravitational waves.

Anyway, the next years they will get sufficient money from the National Science Foundation to continue their extremely important scientific investigations.

## XI Planck's theory of heat radiation criticized

*Summary - Robitaille and Crothers wrote an article [1] with the same purpose as of this chapter: to present the mistakes in Planck's Theory of Heat Radiation and in Kirchhoff's law of thermal emission. In this chapter an alternative approach is taken, leading to a support of the conclusion as shown in [1]. In other words: Planck, indeed, made a scientific mess of it! Not only Planck's theory makes no sense, the current presentation of this theory turns out to be of this low level too.*

### 1 Introduction

Planck's book about this subject, originally written in 1913, has been translated from the German into the English language by Morton Masius, M. A., Ph. D. (Leipzig) Instructor in Physics in the Worcester Polytechnic Institute. This translated version [2] has been used as reference in this article, just like Robitaille and Crothers did.

The criticism in this article concerns only Part I of his book. The title of Part I is: FUNDAMENTAL FACTS AND DEFINITIONS. This criticism is concentrated on the definition of the variables he introduced and on his expressions and equations based on these variables.

### 2 Chapter I of Part I of Planck's theory of heat radiation

The title of chapter I is: General Introduction. We start the investigation at section 6 in Planck's book.

*“6. Summing up everything said so far, we may equate the total energy in a range of frequency from  $\nu$  to  $\nu + d\nu$  emitted in the time  $dt$  in the direction of the conical element  $d\Omega$  by a volume-element  $d\tau$  to*

$$dt \cdot d\tau \cdot d\Omega \cdot d\nu \cdot 2\varepsilon_\nu \quad (1)$$

*The finite quantity  $\varepsilon_\nu$  is called the coefficient of emission of the medium for the frequency  $\nu$ .*

*It is a positive function of  $\nu$  and refers to a plane polarized ray of definite colour and direction.“*

Remark (1)-1\*:

Considering the use of the word 'energy' the dimension of expression (1) must be W.s or Joule.

The dimensions of the separate variables are as follows:  $[dt]$ : s,  $[d\tau]$ :  $m^3$ ,  $[d\Omega]$ : no dimension,  $[d\nu]$ :  $s^{-1}$ . Multiplying these dimensions results in the conclusion that  $[\varepsilon_\nu]$  must be:  $W.s/m^3$ .

In words: volume energy density.

**Serious warning (1)-1:**

This doesn't look like the dimension of an emission coefficient. In modern radiation theories  $\varepsilon_\nu$  is dimensionless, however not called coefficient of emission but emissivity.

Remark (1)-2:

Planck does neither define the conical element  $d\Omega$ , nor the volume-element  $d\tau$ . The definition of  $d\Omega$  can be deduced from Planck's text below:  $d\Omega$  must have been meant to be the derivative of the so-called solid angle (symbol:  $\Omega$ ).

*“Since  $\varepsilon_\nu$  is independent of the direction, and since the integral over all conical elements  $d\Omega$  is  $4\pi$ , we get:*

$$dt \cdot d\tau \cdot 8\pi \int \varepsilon_\nu d\nu \quad (2)''$$

Remark (2)-1:

Since Planck likely is considering a sphere, with whatever radius,  $d\tau$  must be meant to be a volume-element of this sphere.

For reasons of completeness we now first copy Planck's definition of his coefficient of scattering and then jump to section 12 for his definition of the so-called coefficient of absorption.

\* “Remark (e)-n” means: remark concerning equation/expression (e)-numbered n.



“Whether the scattering depends on reflection, on diffraction, or on a resonance effect on the molecules or particles is a point that we may leave entirely aside. We only take account of the fact that every ray on its path through any medium loses a certain fraction of its intensity. For a very small distance,  $s$ , this fraction is proportional to  $s$ , say

$$\beta_v s \tag{3}$$

where the positive quantity  $\beta_v$  is independent of the intensity of radiation and is called the ‘coefficient of scattering’ of the medium.”

Remark (3)-1:

At this moment we don’t know yet what Planck exactly means with intensity, so we cannot yet conclude what the dimension of  $\beta_v$  is.

“**12. Absorption.** -Heat rays are destroyed by “absorption.” According to the principle of the conservation of energy the energy of heat radiation is thereby changed into other forms of energy (heat, chemical energy). Thus only material particles can absorb heat rays, not elements of surfaces, although sometimes for the sake of brevity the expression absorbing surfaces is used. Whenever absorption takes place, the heat ray passing through the medium under consideration is weakened by a certain fraction of its intensity for every element of path traversed. For a sufficiently small distance  $s$  this fraction is proportional to  $s$ , and may be written

$$\alpha_v s \tag{4}”$$

Remark (4)-1:

Planck clearly considers fractions of energy, so  $[\alpha_v s]$  must be W.s, leading to the conclusion that  $[\alpha_v]$  must be W.s/m. Based on this conclusion it may be assumed that  $[\beta_v]$  is also meant to be W.s/m. Later on this assumption indeed will turn out to be correct.

**Serious warning (4)-1:**

The dimension of  $\alpha_v$  as W.s/m doesn’t look like the dimension of an absorption coefficient.

In modern radiation theories  $\alpha_v$  is dimensionless!

The same criticism applies of course for the coefficient of scattering  $\beta_v$ .

We jump to equations (5) and (6) in section 15.

“The intensity in this direction is the energy propagated in an infinitely thin cone limited by  $\Theta$  and  $\Theta + d\Theta$  and  $\phi$  and  $\phi + d\phi$ . The solid angle of this cone is

$$d\Omega = \sin\Theta \, d\Theta \, d\phi \tag{5}$$

Thus the energy radiated in time  $dt$  through the element of area  $d\sigma$  in the direction of the cone  $d\Omega$  is:

$$dt \, d\sigma \, \cos\Theta \, d\Omega \, K = K \sin\Theta \, \cos\Theta \, d\Theta \, d\phi \, d\sigma \, dt \tag{6}”$$

Remark (5)-1:

This concept of solid angle is not appropriate to apply in such a theory.

Besides that  $d\Omega$ , as presented in (5), is indeed the derivative of the solid angle

$\Omega = \iint_S \sin\Theta \, d\Theta \, d\phi$ , so not a solid angle. See also Remark (1)-2.

Remark (6)-1:

One of the consequences of the just mentioned misconception is that the radiated energy, as shown in (6), would not only depend on  $\theta$ , but would even be zero for  $\theta = 0$ .

Remark (6)-2:

If both sides of (6) are indeed meant to be energies, we have to conclude that

$[K] = \text{W.s/s/m}^2 = \text{W/m}^2$ . In words:  $K$  is the surface power density of the radiation.

We now make a big jump to section 22, the text in between considering not relevant enough to investigate. The relevant variable introduced in this part of his theory is  $K_v$ , defined as the spectral surface power density:  $K = K_v \, dv$ , with  $v$  representing frequency.

Planck now and then also considers a  $K'_v$ , with the following background.

“A last characteristic property of a ray of definite direction, intensity, and colour is its state of polarization. If we break up a ray, which is in any state of polarization whatsoever and which travels in a definite direction and has a definite frequency  $\nu$ , into two plane polarized components, the sum of the intensities of the components will be just equal to the intensity of the ray as a whole, independently of the direction of the two planes, provided the two planes of polarization, which otherwise may be taken at random, are at right angles to each other.”

He concludes with: 
$$K = \int (K_\nu + K'_\nu) d\nu \quad (9)$$

Remark (9)-1:

This splitting up in two different polarized components doesn't make sense, given his ultimate purpose: define a spectral surface power density  $K_\nu$  by means of  $K = K_\nu d\nu$ .

“22. Since the energy radiation is propagated in the medium with a finite velocity  $q$ , there must be in a finite space a finite amount of energy. We shall therefore speak of the “space density of radiation,” meaning thereby the ratio of the total quantity of energy of radiation contained in a volume-element to the magnitude of the latter. Let us now calculate the space density of radiation  $u$  at any arbitrary point of the medium. When we consider an infinitely small element of volume  $v$  at the point in question, having any shape whatsoever, we must allow for all rays passing through the volume-element  $v$ . For this purpose we shall construct about any point  $O$  of  $v$  as centre of a sphere with radius  $r$ ,  $r$  being large compared with the linear dimensions of  $v$  but still so small that no appreciable absorption or scattering of the radiation takes place in the distance  $r$  (Fig. 1).

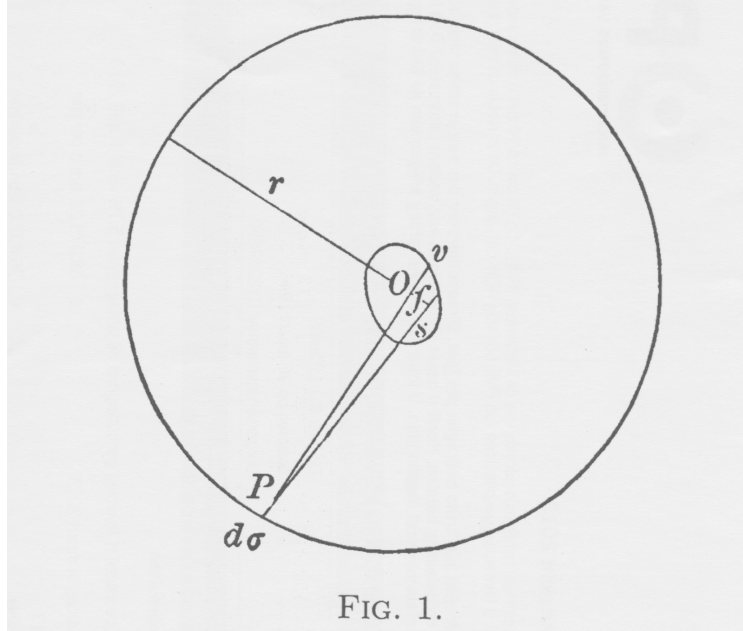


FIG. 1.

Every ray which reaches  $v$  must then come from some point on the surface of the sphere. If, then, we at first consider only all the rays that come from the points of an infinitely small element of area  $d\sigma$  on the surface of the sphere, and reach  $v$ , and then sum up for all elements of the spherical surface, we shall have accounted for all rays and not taken any one more than once.

Let us then calculate first the amount of energy which is contributed to the energy contained in  $v$  by the radiation sent from such an element  $d\sigma$  to  $v$ . We choose  $d\sigma$  so that its linear dimensions are small compared with those of  $v$  and consider the cone of rays which, starting at a point of  $d\sigma$ , meets the volume  $v$ . This cone consists of an infinite number of conical elements with the common vertex at  $P$ , a point of  $d\sigma$ , each cutting out of the volume  $v$  a certain element of length, say  $s$ . The solid angle of such a conical element is  $f/r^2$  where  $f$  denotes the area of cross-section normal to the axis of the cone at a distance  $r$  from the vertex. The time required for the radiation to pass through the distance  $s$  is  $\tau = s/q$ .

From expression (6) we may find the energy radiated through a certain element of area. In the present case  $d\Omega = f/r^2$  and  $\theta=0$ ; hence the energy is:

$$\tau d\sigma f r^2 K = f s r^2 q^{-1} K d\sigma \quad (19)''$$

## Comment

In order to try to understand Planck's way of thinking, all variables defined above have been defined again shortly in sequence of Planck's description:

q	propagation velocity of radiation in a certain medium
u	space density of radiation at any arbitrary <b>point</b> of the medium
v	infinitely small element of volume, at the <b>point</b> as mentioned just above
O	centre of v (so O is that <b>point</b> )
r	radius of the sphere with O as centre (sphere is significant larger than v)
dσ	infinitely small surface at the surface of the sphere with radius r
P	point of dσ from which an infinite number of <b>conical elements</b> reach v
s	length of an element in v cut out by such a <b>conical element</b>
f	the cross section at distance r from P of such a <b>conical element</b>
τ	time required for the radiation to pass through the distance s (τ=s/q)
dΩ	solid angle of such a <b>conical element</b> (dΩ=f/r <sup>2</sup> )

Remark (19)-1:

His definition of dΩ here is in contradiction with the one he applied in (5) and (6)!  
But this definition is at least a correct one.

Remark (19)-2:

Equation (19) would, without the incorporation of a conical element, already be a presentation of the energy of a ray with surface power density K, emitted by surface dσ during time τ. The addition of the conical element with solid angle f/r<sup>2</sup> therefore doesn't make sense.

Remark (19)-3:

The conical element with solid angle f/r<sup>2</sup> is defined as having its vertex in point P, located in dσ, while the area dσ is used to calculate the energy emitted in the direction of v.  
That implies a double, but opposite, use if this, already senseless, variable.

Remark (19)-4:

Up to now Planck did not yet define what in fig. 1 has to be considered as the body that emits the radiation. He gives the impression that it is the inner side of the sphere with radius r, because finally he multiplies the assumed homogeneous intensity K with this surface: 4πr<sup>2</sup>, resulting in a totally emitted energy by that body of 4πr<sup>2</sup>K.τ (Ws).

Remark (19)-5:

Based on the considerations under remark (19)-4 we have to conclude that the introduction of the so-called volume v doesn't make any sense.

Planck continues after (19) as follows:

*"This energy enters the conical element in v and spreads out into the volume f.s. Summing up over all conical elements that start from dσ and enter v we have*

$$K d\sigma r^2 q^{-1} \sum f s = K d\sigma r^2 q^{-1} v \quad (19.1)$$

Remark (19.1)-1: (For the ease of reference this equation is numbered 19.1 by the author.)

Equation (19) represents energy, only due to the fact that a power, generated during a period τ, is considered. In (19.1) Planck replaces this multiplication with time τ by introducing some arbitrary distance s, divided by the propagation velocity of radiation q. This arbitrary s leads to an arbitrary volume v by multiplying s with surface f.

As a result the expression  $K d\sigma r^2 q^{-1}$  now represents a volume energy density as function of the propagation velocity of radiation. This is, seen from a physical point of view, illogical.

Remark (19.1)-2:

Assumed that a volume energy density would be of any interest in this stage of the development of his theory, he simply could have divided the, under Remark (19)-4 mentioned, energy  $4\pi r^2 K \cdot \tau$  by the volume of the sphere  $(4/3)\pi r^3$ , resulting in such an energy density of  $3K/r \cdot \tau$  (Ws/m<sup>3</sup>) and a total energy of  $v \cdot 3K/r \cdot \tau$  (Ws) contained in  $v$ .

This outcome emphasizes the conclusion as given in Remark (19)-5.

Besides that: the incorporation of the propagation velocity of radiation in an expression for energy, as shown in (19.1), is illogical from a physical point of view.

These two variables don't have a physical relation. The power is a property of the emitter and the energy the time during which this power is emitted.

Planck continues with:

*“This represents the entire energy of radiation contained in the volume  $v$ , so far as it is caused by radiation through the element  $d\sigma$ . In order to obtain the total energy of radiation contained in  $v$  we must integrate over all elements  $d\sigma$  contained in the surface of the sphere. Denoting by  $d\Omega$  the solid angle  $d\sigma/r^2$  of a cone which has its centre in  $O$  and intersects in  $d\sigma$  the surface of the sphere, we get for the whole energy:*

$$v/q \int K d\Omega \quad (19.2)$$

Remark (19.2)-1:

Planck changes his definition of  $d\Omega$  again, now from  $df/r^2$  into  $d\sigma/r^2$ , with  $d\sigma$  being an infinitely small surface element at distance  $r$ , emphasizing that it is “a cone which has its centre in  $O$ ”, while  $df$  is an infinitely small surface element in the neighbourhood of  $O$ .

*“The volume density of radiation required is found from this by dividing by  $v$ . It is*

$$u = q^{-1} \int K d\Omega \quad (20)$$

*Since in this expression  $r$  has disappeared, we can think of  $K$  as the intensity of radiation at the point  $O$  itself. In integrating, it is to be noted that  $K$  in general depends on the direction ( $\Theta$ ,  $\phi$ ). For radiation that is uniform in all directions  $K$  is a constant and on integration we get:*

$$u = 4\pi K/q \quad (21)''$$

Remark (21)-1:

The mistake, mentioned under Remark (19.2)-1, can be neglected by arguing that he finally only meant to integrate the term  $K d\sigma r^2 q^{-1} v$  (19.1) over the surface of the sphere.

$K$  is assumed to be homogeneous, so  $d\sigma$  is allowed to be replaced by  $4\pi r^2$ .

This also results in (21), after dividing by  $v$ , like Planck did to get (20) out of (19.2).

Remark (21)-2:

Here the last sentence from Remark (19.1)-2 is recalled and a closer consideration of the concept ‘volume energy density’ presented.

Multiplying the surface power density  $K$  of an emitter by a certain surface, results in the power of the emitter at the place of and integrated over that surface. If this surface would be the surface of a sphere with radius  $r$ , assuming that the emitter indeed homogeneously emits its power in all directions, then the value of this power is  $K \cdot 4\pi r^2$ .

However it is impossible to transform this quantity to a volume energy density, because it would be required to multiply this power with, for example, a time period  $\tau$  to get energy and a volume to divide by. But which volume has to be related to this surface and time?

The misunderstanding regarding the concept ‘volume energy density’ starts at the introduction of the concept ‘spectral surface power density’ as already shown in (9).

The dimension of spectral surface power density is  $W/m^2/\text{Hertz} = W \cdot s/m^2$ , which can also be interpreted as surface energy density, but is clearly not meant to be.

The misconception ‘volume energy density’ is only found in the weird definition of  $\epsilon_v$ , as explained under Remark (1)-1.

“23. A meaning similar to that of the volume density of the total radiation  $u$  is attached to the volume density of radiation of a definite frequency  $u_\nu$ . Summing up for all parts of the spectrum we get:

$$u = \int u_\nu d\nu \quad (22)$$

Further by combining equations (9) and (20) we have:

$$u_\nu = q^{-1} \int (K_\nu + K'_\nu) d\Omega \quad (23)$$

and finally for unpolarized radiation uniformly distributed in all directions:

$$u_\nu = 8\pi K_\nu / q \quad (24)$$

Remark (24)-1:

Planck here makes the mistake by replacing  $K$  in (20) by  $K_\nu + K'_\nu$  instead of only  $K_\nu$ .

See Remark (9)-1 for the explanation. The factor 8 therefore has to be 4, given the definition of  $K_\nu$  implicitly in:  $K = K_\nu d\nu$ . The  $K_\nu$  in (24) effectively is  $1/2 K / d\nu$ .

Here Chapter I of Planck's book ends.

### 3 Chapter II of Part I of Planck's theory of heat radiation

The title of chapter II is:

Radiation at thermodynamic equilibrium. Kirchoff's law. Black radiation

From this chapter in principle only relevant formulas are scrutinized, because a lot has already been investigated in the previous chapter I.

We start at page 30 with:

“The amount of energy of this ray absorbed in the distance  $s$  in the time  $dt$  is, according to (4),

$$dt \alpha_\nu s \int d\sigma \int r^{-2} K_\nu d\nu \quad (n1)$$

For the explanation of and the criticism about  $\alpha_\nu s$  see above, before and after (4).

Remark (n1)-1:

A fundamental mistake is made by Planck in this equation. As shown in Remark (4)-1 the dimension of  $\alpha_\nu$  is  $Ws/m$  (see also “Serious warning (4)-1”). With this (wrong) dimension of  $\alpha_\nu$  the dimension of the expression under consideration becomes:

$$s (Ws/m) m^2 m^2 m^{-2} (Ws/m^2) s^{-1} = W^2 s^2 !$$

This dimension has to be  $Ws$ , as follows from the words “ amount of energy” in the description. Besides that: what might  $W^2 s^2$  physically mean?

The “Serious warning (4)-1” therefore is confirmed with this observation.

There can be only one reason for such a blunder, however resulting in an even more worse one: Planck all of a sudden must have changed the dimension of  $\alpha_\nu$  at the start of Chapter II into  $m^{-1}$ , notwithstanding his reference to (4), realizing otherwise the stupid dimension  $W^2 s^2$  of (n1).

**Fatal error 1:**

**Doing so he ruins the contents of Chapter I. But if he would have left it like that, it would have ruined the contents of Chapter II.**

Besides that: the dimension  $m^{-1}$  for the absorption coefficient  $\alpha_\nu$ , and as a result also for the coefficient of scattering  $\beta_\nu$ , is anyway a weird one.

At this place there are two possibilities to do: stop the investigation and declare Planck's work on heat radiation completely false, or change the dimension of  $\alpha_\nu$  in  $m^{-1}$ , disregarding for the moment this at least weird dimension too and see what will happen after that.

The second possibility is chosen, only for reasons of curiosity, because he ruined already his previous work by many other mistakes as shown above and in ref. [1].

We jump to the following, neither numbered, equation on the same page 30 at the end;

“By equating the emitted and absorbed energy we obtain:

$$\int \varepsilon_v dv = \int \alpha_v K_v dv \quad “ \quad (n2)$$

Remark (n2)-1:

With the new dimension of  $\alpha_v$  ( $m^{-1}$ ), the dimension of the right hand side of this equation is  $m^{-1} \cdot (Ws/m^2) \cdot s^{-1} = W/m^3$ . If we take the original dimension of  $\varepsilon_v$ , being  $Ws/m^3$ , as shown in Remark (1)-1 as well as in ref.[1], the dimension of the left hand side of the equation is also  $W/m^3$ . Great, we will continue, however still with the weird dimensions for  $\varepsilon_v$ ,  $\alpha_v$  and for  $\beta_v$  !

In section 28 Planck comes back with the phenomenon ‘scattering’, defining the scattering coefficient  $\beta_v$  in exactly the same way as the absorption coefficient (see also (2) and (3)):

“Hence we get an expression similar to (25), namely,

$$dt v 8 \pi \int \beta_v K_v dv \quad (28)”$$

In (25)  $\alpha_v$  instead of  $\beta_v$  is taken in exactly such a presentation.

We jump to section 30

**30.** Let a certain volume-element of the pencil be bounded by two cross-sections at distances equal to  $r_0$  (of arbitrary length) and  $r_0 + dr_0$  respectively from the vertex O. The volume will be represented by  $dr_0 \cdot r_0^2 d\Omega$ . It emits in unit time toward the focal plane  $d\sigma$  at O a certain quantity E of energy of monochromatic plane polarized radiation. E may be obtained from (1) by putting

$$dt = 1, \quad dt = dr_0 \cdot r_0^2 d\Omega, \quad d\Omega = d\sigma / r_0^2$$

and omitting the numerical factor 2. We thus get:

$$E = dr_0 \cdot d\Omega d\sigma \varepsilon_v dv \quad (31)$$

Of the energy E, however, only a fraction  $E_0$  reaches O, since in every infinitesimal element of distance  $s$  which it traverses before reaching O the fraction  $(\alpha_v + \beta_v)s$  is lost by absorption and scattering. Let  $E_r$  represent that part of E which reaches a cross-section at a distance  $r$  ( $< r_0$ ) from O. Then for a small distance  $s = dr$  we have

$$E_{r+dr} - E_r = E_r (\alpha_v + \beta_v) dr,$$

or,

$$dE_r / dr = E_r (\alpha_v + \beta_v), \quad “ \quad (n3)$$

Remark (31)-1:

The introduction of the constant  $r_0$  is superfluous, but more serious: misleading. If  $r_0$  would be replaced by  $r$ , nothing changes up to and including equation (n3).

“and, by integration,

$$E_r = E e^{-(\alpha_v + \beta_v)(r - r_0)}$$

since, for  $r = r_0$ ,  $E_r = E$  as given by equation (31). From this, by putting  $r = 0$ , the energy emitted by the volume-element at  $r_0$ , which reaches O is found to be

$$E_0 = E e^{-(\alpha_v + \beta_v)r_0} = dr_0 d\Omega d\sigma \varepsilon_v e^{-(\alpha_v + \beta_v)r_0} dv \quad (32)”$$

**Fatal error 2:**

**The chosen approach here is fundamentally wrong!**

The misleading mentioned under remark (31)-1 pups up here. Equation (31) should have been written as  $E_{r0} = dr_0 \cdot d\Omega \cdot d\sigma \cdot \epsilon_v \cdot dv$ . If  $r$  instead of  $r_0$  would have been used, (31) would have been written on the left side as  $E_r$ . So the equation  $E_r = E$  is misleading, because in fact it means  $E_r = E_r$ . Writing the equation  $dE_r/dr = E_r(\alpha_v + \beta_v)$  as  $dE_r/dr = f_v E_r$  it is clear that the solution of this differential equation is:  $E_r = C e^{f_v r}$ , left with the question what  $C$  might be.

It is not allowed to answer this question by introducing an arbitrary distance  $r_0$ , as is done by Planck. In fact one has to answer the question what  $E_r$  might be for  $r=0$ .

So the final solution of the differential equation is:  $E_r = E_0 e^{(\alpha_v + \beta_v)r}$  with  $E_0$  yet undefined.

The solid angel  $d\Omega$  is valid for every  $r$ , so  $d\sigma = d\Omega \cdot r^2$ . If  $r$  approaches 0,  $d\sigma$  approaches 0 too, leading to  $E_0 = 0$ , as follows from (32).

Notwithstanding this second fatal error, and not to forget all the other errors, we still continue by jumping to section 33 where the famous figure 3 is presented, because we still want to consider Planck's argumentations for Kirchhoff's law of thermal emission.

The reference for most of the relevant mathematics below is found in the just mentioned figure below, presented in Planck's book as figure 3.

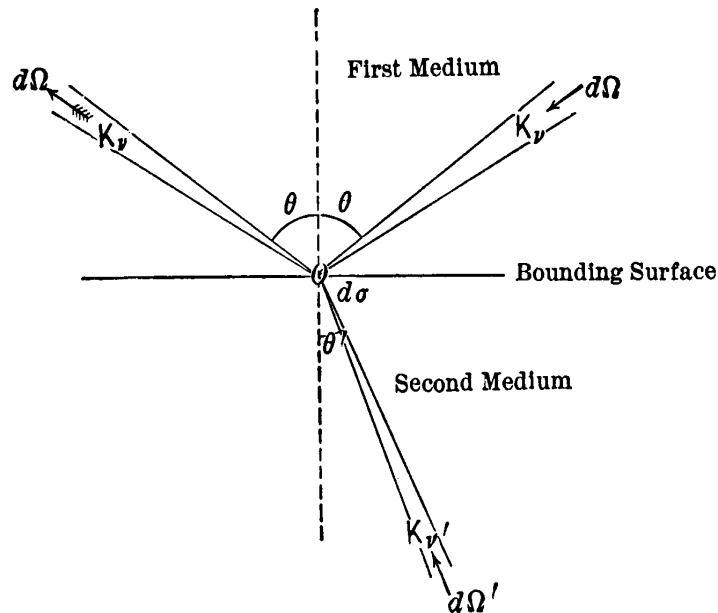


Figure 3

The figure is meant to present the situation in which two media are considered, separated by the so called bounding surface and that *“every ray coming from the first medium and falling on the bounding surface is divided into two rays, the reflected and the transmitted ray.”*

The variable  $\rho$  is introduced as the coefficient of reflection representing the fraction of the energy of the incident ray that is reflected and  $1-\rho$  as the fraction of the energy of the incident ray that is transmitted into the second medium.

**Comment 1 on Figure 3:**

The figure doesn't show the transmitted ray into the second medium. It only shows the reflected one into the first medium. The ray in the second medium is meant as an incident ray, as can be concluded from the following text.

Planck continues with: “*Similar remarks apply to  $\rho$ ’ the coefficient of reflection of a ray coming from the second medium and falling on the bounding surface.*”

Somewhat earlier in his text he stated: “*..... and, in general, let all quantities referring to the second medium be indicated by the addition of an accent.*”

Comment 2 on Figure 3:

The figure would have been complete if Planck would have drawn a conical element  $d\Omega'$  in the lower left hand quadrant at an incident angle of  $\Theta'$ . That conical element would have represented as well the transmitted energy from the incident ray out of the first medium, as the reflected energy in the second medium.

At this place Planck makes a crucial statement:

”*Now according to (11)\* we have for the monochromatic plane polarized radiation of frequency  $\nu$ , emitted in time  $dt$  toward the first medium (in the direction of the feathered arrow upper left hand in Fig. 3), from an element  $d\sigma$  of the bounding surface and contained in the conical element  $d\Omega$ ,*

$$dt d\sigma \cos\Theta d\Omega K_\nu d\nu \quad (34)$$

where

$$d\Omega = \sin\Theta d\Theta d\phi \quad (35)$$

*This energy is supplied by the two rays which come from the first and the second medium and are respectively reflected from or transmitted by the element  $d\sigma$  in the corresponding direction (the unfeathered arrows).*”

\* Equation (11) is equal to (34) with the application of (35) in (34)

**Fatal error 3:**

See remark (5)-1 copied here:

This concept of solid angle is not appropriate to apply in such a theory.

Besides that  $d\Omega$ , as presented in (5), is indeed (see Remark (1)-2 ) the derivative of the solid angle  $\Omega = \iint_S \sin\Theta d\Theta d\phi$ , so not a solid angle.

Planck also wrongly ‘proved’

$$q^2 K_\nu = q'^2 K'_\nu \quad (41)''$$

by applying the same misconception of  $d\Omega$ .

**Fatal error 4:**

N.B. The variable  $K'_\nu$  in this equation doesn’t have anything to do with the  $K'_\nu$  as introduced in (9), as shows his description below!

He states in section 39:

“*The second formula (41) establishes a relation between the intensities of radiation in the two media, for it states that, when thermodynamic equilibrium exists, the specific intensities of radiation of a certain frequency in the two media are in the inverse ratio of the squares of the velocities of propagation or in the direct ratio of the squares of the indices of refraction.*

*By substituting for  $K_\nu$  its value from (27) ( $K_\nu = \epsilon_\nu/\alpha_\nu$ ) we obtain the following theorem:*

*The quantity*

$$q^2 K_\nu = q^2 \epsilon_\nu / \alpha_\nu \quad (42)$$

*does not depend on the nature of the substance, and is, therefore, a universal function of the temperature  $T$  and the frequency  $\nu$  alone.*”

We applied the dimension  $m^{-1}$  of  $\alpha_\nu$  , notwithstanding the background as shown in Fatal error 1.



In the mean time Planck did not change the dimension of  $\epsilon_v$  (W.s/m<sup>3</sup>). So at this moment [ $\epsilon_v/\alpha_v$ ] is W.s/m<sup>2</sup>, indeed equal to the dimension of  $K_v$  (W/m<sup>2</sup>/Hertz).

In the next section of this article the criticism will be concentrated on Kirchhoff's law of thermal emission as presented by Planck.

In the section after that attention will be paid to the modern way of presenting this law.

#### 4 Kirchhoff's law of thermal emission presented by Planck

Planck based Kirchhoff's law on (41). The consequences of that will be investigated below.

*“42. We shall now consider a system in a state of thermodynamic equilibrium, contained within an enclosure impermeable to heat and consisting of n emitting and absorbing adjacent bodies of any size and shape whatever. As in Sec. 36, we again confine our attention to a monochromatic plane polarized pencil, which proceeds from an element  $d\sigma$  of the bounding surface of the two media in the direction toward the first medium (Fig. 3, feathered arrow) within the conical element  $d\Omega$ . Then, as in (34), the energy supplied by the pencil in unit time is*

$$d\sigma \cos\Theta d\Omega K_v dv = I \quad (43)''$$

By stating: *“...the energy supplied by the pencil in unit time is....”* Planck implicitly gave the variable I the dimension power, instead of energy, not in contradiction (this time!) by the fact that [ $K_v dv$ ] = W/m<sup>2</sup>. Based on the text: *“.. consisting of n emitting and absorbing adjacent bodies...”* he then creates

$$I = I_1 + I_2 + I_3 + \dots I_n \quad (44)$$

The variable J is set equal to I by the following consideration.

*“43. The most adequate method of acquiring more detailed information as to the origin and the paths of the different rays of which the radiations  $I_1, I_2, I_3, \dots I_n$  consist, is to pursue the opposite course and to inquire into the future fate of that pencil, which travels exactly in the opposite direction to the pencil I and which therefore comes from the first medium in the cone  $d\Omega$  and falls on the surface element  $d\sigma$  of the second medium. For since every optical path may also be traversed in the opposite direction, we may obtain by this consideration all paths along which rays can pass into the pencil I, however complicated they may otherwise be. Let J represent the intensity of this inverse pencil, which is directed toward the bounding surface and is in the same state of polarization. Then according to Sec. 40,*

$$J = I \quad (45)''$$

Planck means, in the end, by *“Then according to Sec. 40,”* according to the conclusion that  $q^2K_v = q^2K'_v$ . As has been proven above, this conclusion is wrong, so (45) is invalid.

The variable J is, just like I, split up in n components claiming that

$$I_i = J_i \quad (46)$$

continuing with:

*“44. Following G. Kirchhoff (Gesammelte Abhandlungen, 1882, p. 574) we call the quantity  $I_2$ , i.e. , the intensity of the pencil emitted from the second medium into the first, the emissive power E of the second medium, while we call the ratio of  $J_2$  to J, i.e. , that fraction of a pencil incident on the second medium which is absorbed in this medium, the absorbing power A of the second medium. Therefore*

$$E = I_2 (\leq I), \quad A = J_2/J (\leq 1) \quad (47)''$$

Remark (47)-1:

It is extremely careless to qualify A as an absolute power, clearly showing that it is a relative one, being related to the power J.

Notwithstanding this pertinent error Planck comes up with the following statement, repeating that A is a power:

*“With these assumptions, according to equations (46), (45), and (43), Kirchhoff’s law holds,*

$$E/A = I = d\sigma \cos\Theta d\Omega K_\nu d\nu \quad (48)$$

*i.e. , the ratio of the emissive power to the absorbing power of any body is independent of the nature of the body.”*

Indeed, if E is set equal to  $I_2$  and A to  $J_2/J$  then  $E/A = J \cdot (I_2/J_2) = I$ , because Planck assumed as well  $I = J$  as  $I_1 = J_1$ . However it has not been proven at all that  $I = J$ .

The outcome (48) would have been the same if he directly would have written:  $E=I$  and  $A=J/J=1$ , clearly showing to be a complete useless exercise.

Planck did so in section 45:

*“45. When in particular the second medium is a black body (Sec. 10) it absorbs all the incident radiation. Hence in that case  $J_2 = J$ ,  $A = 1$ , and  $E = I$ , i.e. , the emissive power of a black body is independent of its nature. Its emissive power is larger than that of any other body at the same temperature and, in fact, is just equal to the intensity of radiation in the contiguous medium.”*

While (48) thus is meant to represent the second medium as a not-black body, so seemingly not “absorbing all the incident radiation”, still E would equal I. A contradiction in terminis.

So all the words in section 42 up to and including 45 are senseless, because the start point was the same as the end point: equation (43), ornate with a inapplicable conical element  $d\Omega$ .

As a result Kirchhoff’s law of thermal emission is an empty, but above all misleading, law.

## 5 Kirchhoff’s law of thermal emission in modern presentations

If one looks for “Kirchhoff’s law of thermal emission” on the Internet, the result is for example just:  $\alpha_\nu = \epsilon_\nu$ . Given the weird definitions of these variables by Planck, it might be interesting to look for them on the Internet too.

Copied from reference [3], having changed  $\lambda$  into  $\nu$ . (The text itself starts with frequency!)

“In the second system, therefore, at each frequency, the walls must absorb and emit energy in such a way as to maintain the black body distribution. For the condition of thermal equilibrium, the absorptivity  $\alpha_\nu$  is the ratio of the energy absorbed by the wall to the energy incident on the wall, for a particular frequency. Thus the absorbed energy is  $\alpha_\nu E_{b\nu}(\nu,T)$  where  $E_{b\nu}(\nu,T)$  is the intensity of black body radiation at frequency  $\nu$  and temperature T. Independent of the condition of thermal equilibrium, the emissivity of the wall is defined as the ratio of emitted energy to the amount that would be radiated if the wall were a perfect black body. The emitted energy is thus  $\epsilon_\nu E_{b\nu}(\nu,T)$  where  $\epsilon_\nu$  is the emissivity at frequency  $\nu$ . For the maintenance of thermal equilibrium, these two quantities must be equal, or else the distribution of photon energies in the cavity will deviate from that of a black body. This yields Kirchhoff’s law:  $\alpha_\nu = \epsilon_\nu$ .”

In order to understand what is exactly meant here, this text will be scrutinized.  
We start with:

“ $E_{b\nu}(\nu,T)$  is the intensity of black body radiation at frequency  $\nu$  and temperature T.”

This description forces us to define unambiguously the term ‘black body radiation’.  
For that reason several sources on the Internet have been opened.

It is found that definitions of just black body and of black body radiation are mixed up.

The conclusion is that the best definition of a black body is:

**A blackbody absorbs all radiation, incident on its surface**

It is chosen as the best one, because it clearly implies that a body would not be called black if it would not absorb all radiation incident on its surface, ending up at the white body that doesn't absorb radiation at all.

The best definition of black body radiation is found to be the following:

**Black body radiation is radiation that shows a specific, mathematically presented spectrum as function of frequency  $\nu$  and temperature  $T$ .**

In [2] the following presentations are found for this black body radiation:

$$K = h\nu^3 c^2 / (\exp(h\nu/kT) - 1) \quad (274)$$

and

$$E_\lambda = (hc^2/\lambda^5) / (\exp(hc/k\lambda T) - 1) \quad (276)$$

With  $K$  described as: “..... *the specific intensity of a monochromatic plane polarized ray.....*” and  $E_\lambda$  as: “.....*the specific intensity of a monochromatic ray not to the frequency  $\nu$  but, as is usually done in experimental physics, to the wave length  $\lambda$ ...*”

With  $[h] = \text{Ws}^2$  the dimensions of  $K$  and  $E_\lambda$  become:  $[K] = \text{W/m}^2/\text{Hertz}$  resp.  $[E_\lambda] = \text{W/m}^2/\text{m}$ .

Note: Chapter XXXII proves that the function  $E_\lambda$  has amazingly strange properties. However, this function no longer appears later in this chapter.

Regarding the dimension of  $K$ , Planck should have written  $K_\nu$ , but it can be that the outcome indeed was  $K$ , considering the many mistakes he usually made. It is not considered worth to investigate this further.

Assuming its correctness from now on we will use for this spectral surface power density the expression

$$P_d(\nu) = h\nu^3 c^2 / (\exp(h\nu/kT) - 1)$$

The dimension of  $P_d(\nu)$  is correct, just like the one of  $h\nu/kT$ . (The dimension of the so-called Boltzmann constant  $k$  is  $\text{JK}^{-1}$ )

Planck wrote the following more precise specification of black body radiation:

“*This is the specific intensity of a monochromatic plane polarized ray of the frequency  $\nu$ , which is emitted from a black body at the temperature  $T$  into a vacuum in a direction perpendicular to the surface*”.

Mind the addition: “*into a vacuum in a direction perpendicular to the surface*”

Having found applicable definitions for black body and black body radiation, we go back to the text to be scrutinized in reference [3].

We started with:

“ $E_{bv}(v,T)$  is the intensity of black body radiation at frequency  $v$  and temperature  $T$ .”

Conclusion:  $E_{bv}(v,T) = P_d(v)$ .

The next text to be considered is:

“Independent of the condition of thermal equilibrium, the emissivity of the wall is defined as the ratio of emitted energy to the amount that would be radiated if the wall were a perfect black body. The emitted energy is thus  $\epsilon_v E_{bv}(v,T)$  where  $\epsilon_v$  is the emissivity at frequency  $v$ .”

So only for  $\epsilon_v = 1$  that wall is a black body wall.

Back to the first sentence in the text, copied from reference [3] and shown at the beginning of this section: “In the second system, therefore, at each frequency, the walls must absorb and emit energy in such a way as to maintain the black body distribution.”

The second system is defined as follows:

“One may suppose a second system, a cavity with walls that are opaque, rigid, and not perfectly reflective to any wavelength, to be brought into connection, through an optical filter, with the blackbody enclosure, both at the same temperature.”

It is clear that the second system is meant to be a not-black body, with the consequence that we have to read the sentence under consideration as:

In the not-black body, therefore, at each frequency, the walls must absorb and emit energy in such a way as to maintain the black body distribution.

The word “therefore” refers to the condition that both systems are at the same temperature. This means that, due to the fact that both systems are at thermo equilibrium, the not-black body transfers, as well as in the aspect absorptivity as emissivity, into a black body!

### **Magic physics!**

Next phrase:

“For the condition of thermal equilibrium, the absorptivity  $\alpha_v$  is the ratio of the energy absorbed by the wall to the energy incident on the wall, for a particular frequency. Thus the absorbed energy is  $\alpha_v E_{bv}(v,T)$  where  $E_{bv}(v,T)$  is the intensity of black body radiation at frequency  $v$  and temperature  $T$ ”

As if the condition of thermal equilibrium would determine the absorptivity of a body! Absorptivity is an independent, regarding the circumstances, property of material.

The definition of  $\alpha_v$  is correct: “the ratio of the energy absorbed by the wall to the energy incident on the wall, for a particular frequency”, but the conclusion thereafter is not.

Multiplying the absorptivity of a not-black body with the spectral power density of the emission of a black body and qualifying the result as “the absorbed energy” in the not-black body is extremely unphysical and illogical.

The final conclusion in the reference under consideration:

“For the maintenance of thermal equilibrium, these two quantities ( $\alpha_v E_{bv}(v,T)$  and  $\epsilon_v E_{bv}(v,T)$ ) must be equal, ..... This yields Kirchhoff's law:  $\alpha_v = \epsilon_v$ .”

Clearly a completely irresponsible conclusion.

**Just like has been found in Planck's theory, the modern Kirchhoff's law turns out to be an empty law too, but more serious a misleading one and a shame for physical science.**

## 5 Encore: consideration of the relation $E=hf$

The first time that Planck quotes the quantity  $hf$  in his book is in equation (264), where he describes it as: “energy of an oscillator  $\epsilon=hf$ ”.

For a more extended definition reference [4] is taken, saying:

“The Planck constant (denoted  $h$ , also called Planck's constant) is a physical constant that is the quantum of action, central in quantum mechanics.

First recognized in 1900 by Max Planck, it was originally the proportionality constant between the minimal increment of energy,  $E$ , of a hypothetical electrically charged oscillator in a cavity that contained black body radiation, and the frequency,  $f$ , of its associated electromagnetic wave. In 1905 the value  $E$ , the minimal energy increment of a hypothetical oscillator, was theoretically associated by Einstein with a "quantum" or minimal element of the energy of the electromagnetic wave itself. The light quantum behaved in some respects as an electrically neutral particle, as opposed to an electromagnetic wave. It was eventually called the photon. The Planck–Einstein relation connects the particulate photon energy  $E$  with its associated wave frequency  $f$ :  $E = hf$ .”

In chapter VIII it is proven, and if not, at least made very likely, that a photon is not a particle, but an EM pulse, with a length in the order of magnitude of femto seconds. The energy of (such) a photon turned out to be the difference in kinetic energy of an electron jumping from orbit  $n_1$  to  $n_2$  and doing so, causing an EM source that has to be considered as the source of a photon.

This relation between the difference of these two kinetic energies of an electron and the energy of a photon is described in chapter VIII and will be repeated here shortly.

It is generally accepted that electrons have discrete orbits around the nucleus of the atom. These discrete radii are mathematically represented by  $r_n = n^2 a_0 / Z$ , with  $n$  an integer and  $Z$  the so-called atom number, the number of protons in the nucleus of the atom. The radius  $a_0$  is the so-called Bohr radius, the smallest in the neutral hydrogen atom. The mathematical expression for  $a_0$  is found as follows.

The idea behind the quantitative presentation of the discrete radii is based on the assumption, for whatever reason, that the angular momentum  $m_e v_e r_n$  of the electron is quantized, expressed as:

$$m v r_n = n h / 2\pi$$

with:	$m$	mass of the electron	$9.1 \cdot 10^{-31}$	kg
	$v$	velocity of the electron along its orbit		m/s
	$h$	Planck's constant	$6.626 \cdot 10^{-34}$	kg m <sup>2</sup> s <sup>-1</sup>

Applying this to the relations:

$$F_{cf} = m v^2 / r = F_C = \kappa Z q^2 / r^2$$

With:	$F_C$	the so called Coulomb force		
	$\kappa$	Coulomb's constant $(1/4\pi\epsilon_0)$	$8.99 \cdot 10^9$	Nm <sup>2</sup> C <sup>-2</sup>
	$q$	electric charge of the electron	$1.6 \cdot 10^{-19}$	C

it follows that :

$$r = n^2 h^2 / (4\pi^2 \kappa Z q^2 m) \quad \text{and} \quad v^2 = \kappa Z q^2 / m r$$

$r$  is defined as  $a_0$  for  $n=1$  and  $Z=1$ , so:

$$a_0 = h^2 / (4\pi^2 \kappa q^2 m)$$

The difference in kinetic energy of the electron orbiting in  $n_1$  respectively  $n_2$ , is represented by:

$$\Delta E_{kn} = \frac{1}{2}m(v_1^2 - v_2^2),$$

Resulting in:  $\Delta E_{kn} = hc \cdot Z^2mq^4/(8\epsilon_0^2b^3c) \cdot (1/n_1^2 - 1/n_2^2)$

The Rydberg expression is:

$$1/\lambda = R_\infty (1/n_1^2 - 1/n_2^2)$$

with the following parameters:

$\lambda$	wavelength of the carrier			m
$R_\infty$	Rydberg's constant	$(mq^4)/(8\epsilon_0^2b^3c)$	$1.097 \cdot 10^7$	$m^{-1}$
$\epsilon_0$	dielectric permittivity		$8.854 \cdot 10^{-12}$	As/Vm
$c$	velocity of light in vacuum		$2.999 \cdot 10^8$	m/s

The coefficient in the expression for  $\Delta E_{kn}$  can also be written as:  $Z^2mq^4/(8\epsilon_0^2b^2)$ , thus still showing the dimension 'energy'. This coefficient does not incorporate  $c$  anymore, presented here also to emphasize the correctness of the content of Remark (19.1)-2.

The original coefficient thus is an artificial one, obtained by multiplying nominator and denominator in the just shown reduced one by  $hc$ !

We have to bear in mind that the Rydberg expression is fundamentally based on experimental data, where Rydberg succeeded in deducing this expression from (all) his measurements.

Rydberg's expression can be multiplied by  $c$  in order to obtain frequency ( $f$ ) on the left hand side and then define  $R'_\infty = R_\infty c = mq^4/8\epsilon_0^2b^3$ , resulting in:

$$f = R'_\infty (1/n_1^2 - 1/n_2^2)$$

But still no expression of energy is obtained in this equation of course.

Due to the fact that the dimension of  $b$  is such that the dimension of  $hf$  equals energy, we can now write:

$$hf = R''_\infty (1/n_1^2 - 1/n_2^2) \quad \text{with } R''_\infty = R'_\infty b = R_\infty c b$$

It is clear that this artificial way of applying mathematics can not be used to claim that in general  $E = hf$ . It can only be claimed that the energy of a photon equals the difference in kinetic energy of the orbiting electron, based on the theory and mathematics strating with the expression  $mvr_n = nb/2\pi$  up to and including  $\Delta E_{kn} = (Z^2mq^4/8\epsilon_0^2b^2) \cdot (1/n_1^2 - 1/n_2^2)$ .

The crucial and fundamental question that is left is: why is the expression  $mvr_n = nb/2\pi$  valid?

The answer is that  $b$  is in fact only a help variable!

From  $mvr_n = nb/2\pi$  it follows that  $n_i = 2\pi \cdot mv_i r_{ni}/b$ .

Applying this result in  $(1/n_1^2 - 1/n_2^2)$  shows that  $(1/n_1^2 - 1/n_2^2) = b^2$  times a function of the variables  $m, v_1, r_{n1}, v_2$  and  $r_{n2}$ . Multipling this function by  $Z^2mq^4/(8\epsilon_0^2b^2)$ , indeed eliminates  $b$  in the expression of  $\Delta E_{kn}$ .

Thus the fact that Rydberg found that the frequency  $f$  of a photon is proportional to  $(1/n_1^2 - 1/n_2^2)$  and the fact that it can mathematically be proven that the difference in kinetic energy of an electron, jumping from orbit  $n_1$  to  $n_2$ , is also proportional to  $(1/n_1^2 - 1/n_2^2)$ , doesn't guarantee that the energy of a photon is  $hf$ !

Quote regarding the Rydberg constant:

“The constant first arose as an empirical fitting parameter in the Rydberg formula for the hydrogen spectral series, but Niels Bohr later showed that its value could be calculated from more fundamental constants, explaining the relationship via his "Bohr model". As of 2012,  $R_\infty$  and electron spin g-factor are the most accurately measured fundamental physical constants.”

Niels Bohr's measurements seem to prove that it is allowed to present the energy of a photon as  $hf$ , with  $f$  the frequency of the carrier of the photon.

This must be qualified as extremely coincidental, because it is fundamentally speaking impossible.

**So the relation  $E = hf$  should exclusively be applied to the energy of a photon and a photon should exclusively be defined as an extremely short pulse of an electro-magnetic wave with frequency  $f$ .**

## Conclusions

1. Planck's Theory of Heat Radiation as presented in Part I in [1] contains an unbelievable large number of errors, of which several of the level 'fatal', with the consequence that we are forced to fully reject this part of his book.
2. As a result of conclusion 1 Kirchhoff's law has to be rejected too.
3. The modern version of this law turns out to be an empty one too.
4. Given the extremely bad quality of Planck's Theory of Heat Radiation, the correctness of his spectral surface power density function of a black body cannot be guaranteed.
5. As an encore it has been emphasized, as already put forward in chapter VIII, that basically the energy of a photon is not  $hf$ , but the difference in the kinetic energies of an electron, orbiting the nucleus of an atom, jumping from one orbit to another.
6. In that encore it is argued too that the relation  $E = hf$  is, from a physical point of view, unrealistic but, according to measurements of Niels Bohr, applicable to the energy of a photon. It is therefore recommended to express this extremely coincidental phenomenon strictly by means of the equation  $E_{\text{photon}} = hf$ .
7. A photon has to be considered as an extremely short pulse of an electro-magnetic wave with frequency  $f$ .

## References

- [1] “The Theory of Heat Radiation” Revisited: A Commentary on the Validity of Kirchhoff's Law of Thermal Emission and Max Planck's Claim of Universality  
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## XII Correcting for relativity in GPS makes no sense

*Summary - Showing that the Special Theory of Relativity is an untenable theory, many times leads to the reaction that the GPS is so accurate thanks to the STR corrections. This chapter shows that the supposed relativity errors are by far negligible relative to the errors caused by atmospheric circumstances.*

### 1 Introduction

In [1] the impact of the Special Theory of Relativity, by means of the supposed so-called time dilation, on the accuracy of a Global Positioning System is presented. For more background information a reference herein is made to [2], from now on also referred to as “Ashby”.

This article shows a phenomenon that has a much larger impact on the accuracy of the GPS than the one claimed by the concept “time dilation”. It also shows that this phenomenon leads to errors of the same order of magnitude as shown in [3].

### 2 GPS configuration

In [2] the GPS configuration is described as follows.

“The orbiting component of the GPS consists of 24 satellites (plus spares): four satellites in each of six different planes inclined  $55^\circ$  from Earth’s equatorial plane. The satellites are positioned within their planes so that, from almost any place on Earth, at least four are above the horizon at any time. Orbiting about 20.000 km above Earth’s surface, all satellites have periods of 11 hours and 58 minutes.”

So the angular velocity of the satellites is twice as high as the one of the earth.

The basic equations are:

$$|\mathbf{r} - \mathbf{r}_i| = c(t - t_i) \text{ with } i \text{ representing satellite number } 1 \text{ up to and including } 4$$

$\mathbf{r}$  position of the receiver (on or near the earth’s surface)  
 $\mathbf{r}_i$  position of the  $i^{\text{th}}$  satellite  
 $t_i$  time of emitting a signal from the  $i^{\text{th}}$  satellite  
 $t$  time of the clock of the receiver when it receives the 4 signals simultaneously

The “variable”  $c$  is described in [2] as:

“The fundamental principle on which GPS navigation works is an apparently simple application of the second postulate of special relativity – namely, the constancy of  $c$ , the speed of light.”

### 3 Error budgets

If the above shown definitions of the variables are correct then the system is seemingly be able to detect the simultaneousness of the receiving of the 4 signals. To prevent discussions about this it is also possible to look at the equations in another, more easier, way:  $t$  is the time that at position  $\mathbf{r}$  a signal is simultaneously transmitted to 4 satellites at position  $\mathbf{r}_i$ , where they are received at time  $t_i$  respectively.

Ashby’s argumentation, regarding the impact of the STR on the accuracy of the value of  $\mathbf{r}$ , is that, given  $c$  as a physical constant, the values of  $t_i$  are influenced by time dilation due to the velocity of the satellites. A velocity of 4 km/s is mentioned. That velocity indeed corresponds to an angular velocity twice as high as the one of the earth.

The most important mistake in [2] is that  $c$  is considered as constant on the trajectory  $|\mathbf{r} - \mathbf{r}_i|$ . The satellites orbit at a distance of about 20.000 km above earth’s surface. In between is the atmosphere. Its mean thickness is about 100 km. As generally known the velocity of light in air is certainly not  $c$ .



N.B.  $c$  is the symbol for the velocity of light in vacuum, leaving out for the moment the reference with respect to which this velocity is defined. Therefore this symbol has not been used properly up to now.

*Propagating through air, the velocity  $c$  decreases with the factor  $1/n$ , with  $n$  the so-called refractive index. Due the fact that the refractive index depends on for example temperature, density and relative humidity, the 4 paths along which the 4 signals propagate in general are mutual different and thus is the mean propagation velocity of the light along these 4 paths.*

Suppose the distance between the receiver and satellite  $i$  is  $D_i$ , the mean refractive index of the atmosphere along the path of signal  $i$  to satellite  $i$  is  $n_i$  and the thickness of the atmosphere, along which this mean refractive index is applicable, is  $d_i$ . Then the mean velocity of signal  $i$  is:

$$c_i = \{c(D_i - d_i) + (c/n_i) \cdot d_i\} / D_i = c \{1 - (d_i/D_i) (1 - 1/n_i)\}$$

N.B.  $c_i = c$  for either  $d_i = 0$  or  $n_i = 1$ .

Let us consider the most simple situation, meaning that all  $d_i$ 's, respectively  $D_i$ 's, are mutual equal. Then:

$$c_i - c_j = c (d/D) (1/n_i - 1/n_j) = c (d/D) (n_j - n_i) / n_i n_j$$

If  $n_i$  is rewritten as  $1 + \Delta n_i$ , then  $c_i - c_j = c (d/D) (\Delta n_j - \Delta n_i)$ .

The factor  $n_i n_j$  is omitted, because it only represents a multiplication factor, close to 1, for the accuracy  $\Delta n_j - \Delta n_i$  to be investigated.

The absolute value of the relative difference between the two velocities,  $(c_i - c_j)/c$ , is  $(d/D) \cdot |\Delta n_j - \Delta n_i|$ , resulting in relative time errors of the same value.

According to Ashby, relative time errors are, *due to "time delation"*, considered to be much too large to ignore. He claims relative time errors of about  $10^{-10}$ .

Ashby writes:

$$t' = \sqrt{1 - v^2/c^2} \cdot t \quad (27)$$

Thus, a clock moving relative to a system of synchronized clocks in an inertial frame beats more slowly. The square root in Eq. (27) can be approximately expanded using the binomial theorem:

$$\sqrt{1 - v^2/c^2} \approx 1 - v^2/2c^2 \quad (28)$$

In the GPS, satellite velocities are close to 4000 m/s, so the order of magnitude of the time dilation effect is  $v^2/2c^2 \approx 10^{-10}$ . This is also a huge effect."

The absolute error of a normal GPS is about 15 m [3]: "The standard accuracy of about 15 meters can be.....". Relatively speaking this is an error of  $15/2 \cdot 10^7 \sim 10^{-6}$ .

So Ashby claims an error due to "time dilation" 10.000 times *smaller* than the real error.

The refractive index of air at atmospheric pressure is 1.0003. Above 100 km height the pressure is so low that we can assume a refractive index of 1.

Suppose the mean refractive index of this layer of 100 km is 1.0002, so the mean  $\Delta n_i$  is  $2 \cdot 10^{-4}$ . Suppose 10% of this mean value causes the difference  $|\Delta n_j - \Delta n_i|$ , being  $2 \cdot 10^{-5}$ .

Then  $(d/D) \cdot |\Delta n_j - \Delta n_i| = (100/20000) \cdot 2 \cdot 10^{-5} = 10^{-7}$ .

Compared to the real relative accuracy of  $10^{-6}$  it turns out that the assumed mutual differences in refractive indices are most likely too optimistic.

But besides that, there are several other sources for inaccuracies [3].

The relative error as a result of the relative velocity between satellite and earth surface ((4-2)km/s) is  $2/300000000$ , being about  $10^{-8}$ , so negligible. See the chapters: I, V and VI.

## 4 The misconception: time dilation

Einstein introduced this concept based on, among others, the nonsense hypothesis:

*Any ray of light moves in the “stationary” system of co-ordinates with the determined velocity  $c$ , whether the ray be emitted by a stationary or by a moving body.*

The result is that (atomic) clocks will run with a speed dependant on their state of *constant* velocity. But a clock in a state of constant velocity represents an inertial system. So, given the hypothesis: all physical laws are the same in any inertial system, a clock in a state of an arbitrary constant velocity will not show any deviation.

Satellites can, given their large distance relative to the centre of the earth, be considered as inertial systems!

### Conclusion

Claiming that the GPS is so accurate due to relativity corrections is, for more than one reason, nonsense.

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### XIII Religious science

*Summary - The Special Theory of Relativity is a very “popular” theory among physicists, so don’t dare to state that it is a nonsense theory. The most basic reason for the weirdness of this theory is the acceptance by almost all physicists of the fact that the velocity of light in vacuum in this theory is fully undefined.*

#### 1 Introduction

A velocity of whatever object or phenomenon is only defined if the reference, with respect to which the object / phenomenon moves, is defined. This forces us to the conclusion that, formally, we should always mention the reference speaking about the velocity of an object or phenomenon. If we mention the velocity of for example a car, everybody knows that we only mean the street as reference and so it is omitted. The speed of an airplane is meant as groundspeed, showing implicitly the reference.

By far the greatest part of physicists is satisfied just stating: the velocity of light in vacuum is  $c$ . By far the most unscientific statement in physics.

#### 2 Award for the most unscientific statement

A few years ago the young student Ryan Chester did win an award of \$250000 by explaining his way of looking at the STR. See [1].

His crucial statements and my corrections are shown hereafter.

In [1] it is claimed that Einstein’s first postulate sounds:

“The laws of physics are the same in any inertial reference frame”.

##### **Comment:**

Einstein’s first postulate is a completely different one, sounding:

*The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of coordinates in uniform translatory motion.*

N.B. At that time the concept “inertial system” with the meant property did not yet exist!

Einstein only considers **2** systems, moving with respect to each other with a constant mutual speed.

If we would still call Einstein’s first postulate “The Principle of Relativity”, just as he did himself, then we have to find another expression for the postulate: the laws of physics are the same in any inertial reference frame, now-a-days qualified as “The Principle of Relativity”.

See chapter I for an alternative expression.

In [1] it is claimed that Einstein’s second postulate sounds:

“Light travels at a constant speed in a vacuum regardless of the speed of the source.”

##### **Comment:**

Einstein’s second postulate in his words sounds:

*Any ray of light moves in the “stationary” system of co-ordinates with the determined velocity  $c$ , whether the ray be emitted by a stationary or by a moving body.*

The quotes around the word stationary tell us already that there is something peculiar about this concept. It turns out that Einstein effectively re-introduced an ether equivalent model with this concept.

See chapter I.



### Attachment to chapter XIII

Subject: Religious science

date: 8 June 2017

Dear members Nobel Committee Physics,

Would you be so kind to pay attention to the following consideration?

One of the postulates in physics sounds: all physical laws are the same in any inertial system.

A consequence of this postulate is that the time measurement of (atomic) clocks, moving with constant speed, are not influenced by such a speed.

This conclusion is clearly in contradiction with the outcome of the Special Theory of Relativity (STR).

Another consequence of this postulate is that, given the physical laws of Maxwell, the velocity of light in vacuum must be  $c$ , explicitly and only with respect to its inertial source.

This conclusion is flagrantly in contradiction with one of the hypotheses on which the STR is based.

The past decade I have shown thousands of physicists this fundamental proof of the invalidity of the STR. Those physicists, inclusive Nobel laureates, who tried to contest this evidence, used the most weird and/or non-scientific counter arguments.

They give me the impression that they *believe* in the STR like religious people *believe* in the Koran/Bible.

Publication of my article in magazines/arXiv, designated for this purpose, is impossible.

To my opinion due to this religion like believe in the STR.

As a result you will find my article: "Einstein's and Galilei's Relativity" at: <http://vixra.org/abs/1611.0111>

The described attitude of physicists is of course fatal for physical science, leading to its lowest possible level: science fiction.

I'm looking forward to your opinion about the phenomenon presented above.

Kind regards,

Sjaak Uitterdijk

The Netherlands

FYI:

This e-mail has been received too by 2000 (out of a list of 8000) physicists as blind copy.

They are members of the following universities: All in the Netherlands and Belgium, ETH Zürich, Oxford, Cambridge, Imperial College, University College London, Berkeley, Harvard, MIT, Stanford and Cornell. Besides that: Princeton IAS.

## XIV Velocity of cosmic muons most likely much higher than $c$

*Summary - It seems to be the most attractive experiment for physicists, who strongly believe in the validity of the STR, to refer to the supposed half-life time, in combination with their supposed velocity, of muons entering the atmosphere. The crucial part of the experiment is the application of the equation  $E=mc^2$ . This article shows that, by applying this equation, the one error in STR is used to prove the apparent validity of another error in this theory.*

### 1 Introduction

The word muon is the abbreviation of the meant particle:  $\mu$ -meson. In 1963 David H. Frisch and James H. Smith published an article in the American Journal of Physics with the title: Measurement of the Relativistic Time Dilation Using  $\mu$ -Mesons [1]. The abstract starts as follows: “ An experiment has been performed to demonstrate the relativistic time dilation as a large effect.....”. The mentioned large effect is attributed to the supposed velocities of the muons, being almost  $c$ . As a result the STR prescribes large time dilations, which are supposed to influence the half-life time of the muons with the same order of magnitude.

The above mentioned article is taken as reference to dispute the claimed evidence that such an experiment proves the validity of the phenomenon time dilation, as predicted by STR.

### 2 Fundamental assumption

The argumentation of the authors, regarding the claimed similarity between clocks and the half-life time phenomenon, sounds:

“As far as we know the probability of the radioactive decay of subatomic particles, and thus the average time they survive before decaying, is set by forces entirely internal to their structure. Therefore, *any dependence of the decay probability of radioactive particles on their speed is an example of a general property of clocks in motion relative to an observer* rather than a property of the speed of these particular particles relative to anything else in the universe. It is irrelevant, for example, that up to the present era the observer has happened to be on earth.”

Crucial in this argumentation is the following reasoning:

“*any dependence of the.....on their speed is an example of a general property of clocks in motion relative to an observer.....*”

So firstly they take for granted, most likely based on the outcome of the STR, that clocks in motion have a “general property” and that this property depends on the speed relative to the observer.

Expressed in simple words: each observer, having a different speed relative to the observed clock than another observer, will read a different time on that same clock.

Conclusion: each observer does have its own influence on the frequency of the clock, only depending on the relative motion between clock and observer. Any reference “else in the universe” does not have influence on the frequency of the clock, as they state!

If we would exclude physical influence of (the speed of) any observer on the behaviour of the clock, and thus that the clock will not change its frequency as a function of the speed between observer and clock, then the only conclusion is left that the observer is, in some way or another, influenced by the mutual speed between clock and observer.

See chapter I, section 7 for a critical consideration of the “STR-observer”.

Secondly the authors claim that the decaying of muons is an example of the just described interaction between observer and observed clock.

N.B. These truly science fiction-like fundamentals are taken as the basis for the experiment to be carried out!

### 3 Measurement of the speed of the muons

The speed of the muons is calculated from their measured energy. The only kind of energy of an object from which its velocity can be calculated is the kinetic energy.

In stead of using  $E_k = \frac{1}{2}mv^2$ , the authors took the energy prescribed by the STR:  $E = m_r c^2$ , with  $m_r$  the relativistic mass  $m_0/\sqrt{(1-v^2/c^2)}$ .  $m_0$  is the so called 'in-rest-mass'.

Let us abbreviate  $1/\sqrt{(1-v^2/c^2)}$  to  $\gamma$ , as is normally done. So  $m_r = \gamma m_0$  and  $E = \gamma m_0 c^2$ .

By measuring  $E$  in terms of the so-called 'in-rest-energy'  $m_0 c^2$ ,  $\gamma$  will have values starting at 1 and higher. The velocity can now be calculated from these measured values of  $\gamma$ .

In chapter II it has been argued why  $E = m c^2$  is a self-evident non-physical equation.

Therefore now the equation  $E_k = \frac{1}{2}m_0 v^2$  is taken instead of  $E = \gamma m_0 c^2$ , using the same measured energy  $E$ . So  $E_k$  is taken as the real measured  $E$ .

Writing  $E_k$  as  $\frac{1}{2}m_0 c^2 \cdot (v^2/c^2)$ , shows that  $E_k/m_0 c^2 = \frac{1}{2} v^2/c^2$  in genuine physical terms.

In the experiment the outcome of the measurement of the energy  $E$  is expressed in terms of  $m_0 c^2$  by  $\gamma_m$ . So  $\gamma_m = E/m_0 c^2$  is a dimensionless number.

In the experiment under consideration the speed of the muons is calculated from this  $\gamma_m$ , applying  $1/\sqrt{(1-v^2/c^2)} = \gamma_m$ , so the outcome is, by definition, not higher than  $c$ .

However if this  $\gamma_m$  is used to calculate the speed of the muons by applying  $\frac{1}{2} v^2/c^2 = \gamma_m$ , then an arbitrary large  $v$  can be measured.

See table 1, in which  $\gamma_m$  has been calculated as  $\gamma_m = 1/\sqrt{(1-v^2/c^2)}$ , given the chosen values of  $v/c$ , instead of taking arbitrary values.

$v/c$	$\gamma_m(v/c)$	real $v/c$
0	1	1,4
0,900	2	2,1
0,950	3	2,5
0,990	7	3,8
0,995	10	4,5
0,999	22	6,7

Table 1

The results show that the one error in STR is used to prove the apparent validity of another error in this theory.

## Conclusions

Given the postulate: all physical laws are the same in any inertial system, clocks must run synchronously, independent of their velocity, so time dilation does not exist.

Based on the same postulate: the mass of an object can not be influenced by its velocity.

*The postulate justifies the statement that each physical experiment carried out in any inertial system shows the same result. The following mind experiment proves the mentioned conclusion. Suppose two masses at mutual distance  $r$  in an inertial system. Measuring the mutual gravitational force  $Gm_1m_2/r^2$ , will result in the same outcome, independent of the velocity of the inertial system.*

Based on the same postulate: the velocity of light in vacuum can only be  $c$  relative to its source.

As a result:

The STR is invalid, so any restriction on velocities of particles is impermissible.

and thus:

Muons entering the atmosphere most likely do have velocities (much) higher than  $c$ .

## Reference

- [1] <http://physics.gmu.edu/~rubinp/courses/122/readings/AJP000342.pdf>



## XV The time of the photon

*Summary - A lot has been philosophized and written about the phenomenon 'time dilation'. This article shows the consequences applying this phenomenon to a photon, traveling with velocity  $c$ , relative to whichever observer, as the Special Theory of Relativity prescribes.*

### 1 Historical background

A definition of time dilation is found in for example [1]:

“According to the theory of relativity, time dilation is a difference in the elapsed time measured by two observers, either due to a velocity difference relative to each other, or by being differently situated relative to a gravitational field.”

The influence of gravitational forces has not been considered in this article.

“As a result of the nature of spacetime, a clock that is moving relative to an observer will be measured to tick slower than a clock that is at rest in the observer's own frame of reference.”

Spacetime is, in [2], defined as:

“In physics, spacetime is any mathematical model that fuses the three dimensions of space and the one dimension of time into a single four dimensional continuum. Spacetime diagrams are useful in visualizing and understanding relativistic effects such as how different observers perceive where and when events occur.”

Combining the two citations leads to the conclusion that a *mathematical* model is supposed to have a ‘nature’, which is not the same as ‘property’, and that this ‘nature’ is supposed to be responsible for the phenomenon ‘time dilation’.

‘Time dilation’ is originally defined by Einstein as:

A system S moves with constant velocity  $v$  relative to system  $S'$ . If time  $t$  is related to S “(this “ $t$ ” always denotes a time of the stationary system)” and time  $t'$  to  $S'$  then  $t'$ , as function of  $t$  and  $v$ , is:  $t' = \beta(t - vx/V^2)$  with  $\beta = 1/\sqrt{1 - v^2/V^2}$  and  $V$  now-a-days written as  $c$ .

Einstein's conclusion therefore was: a clock mounted in S, showing time  $t$ , will show in  $S'$  time  $t'$ .

Pretty soon the variable  $x$ , by the scientist under consideration defined as a constant in S, has been neglected in the time-transformation formula. Most likely because it made the expression immediately extremely suspicious regarding its credibility.

So what is left now-a-days is:  $t' = \gamma t = t/\sqrt{1 - v^2/c^2}$ . Might it be that  $\beta$  has been changed into  $\gamma$  in order to obtain a less suspicious change, after having eliminated the variable  $x$  without any explanation?

### 2 Influence of the Principle of Relativity

*The Principle of Relativity has been postulated by Einstein but is a rather restricted version of the postulate that all physical laws are the same in any inertial system. Therefore the words “Principle of Relativity” will not be used hereafter anymore.*

Another problem showed up: the postulate that states that all physical laws are the same in any inertial system, hereafter shortly written as *the postulate*, leading to the conclusion that the same physical experiment, carried out in any inertial system, will show the same result.

Reading a clock is fundamentally carrying out a physical experiment, because a clock is an instrument developed and produced in order to measure the variable ‘time’.

So mounting a clock, based on the same physical laws, in as well S as  $S'$  must lead to the conclusion that they will both show the same time.

Normally such a conclusion should mean: exit Special Theory of Relativity.

Given this contradiction with *the postulate* the approach of the supposed phenomenon ‘time dilation’ has been changed, based on the following consideration.

Clocks indeed do not measure different times in any inertial system, but observers of clocks will observe different 'times' when moving with constant  $v$  relative to clocks! To repeat a citation above:

“As a result of the nature of spacetime, a clock that is moving relative to an observer will be measured to tick slower than a clock at rest in the observer's frame of reference.”

Mind the expression: “a clock ..... will be measured to tick slower ...” !

In sound physical science such a measurement would be qualified as seemingly carried out wrongly, because *the postulate* prescribes that the clock doesn't change the speed of its ticks, whatever observer observes it.

Einstein made a second fundamental mistake by stating that a clock mounted in  $S$  and showing time  $t$  will show time  $t'$  in  $S'$ .

He forgot, the author assumes, to consider that the speed between  $S$  and  $S'$  is mutual, meaning that not only  $S'$  moves with  $|v|$  relative to  $S$ , but also vice versa.

In the expression  $t' = t/\sqrt{(1-v^2/c^2)}$  it doesn't matter whether  $v$  is positive or negative!

As a result it doesn't matter either to what system  $t$  and  $t'$  are assigned.

The expression can also be written as  $t = t' \cdot \sqrt{(1-v^2/c^2)}$  leading to  $t = 0$  for  $v = c$ .

This is an interesting phenomenon from the point of view of a photon, propagating in vacuum with  $v = c$  with respect to whichever observer, as the STR prescribes.

As has been argued it is free to define to what system  $t$  resp.  $t'$  belongs. So suppose  $t'$  belongs to the observer and  $t$  to the photon. Then the observer observes that the clock in the photon does not run ( $t$  is zero). What has to be concluded now?

- that the observer did not observe correctly?
- or that time belonging to the photon does not change/exist?

Those who believe in the correctness of the STR will reject the first possibility.

Chapter XIV shows that the concept of time belonging to, for example, a muon is generally accepted.

So time belonging to a photon must also be an unavoidable concept in STR.

Taking the second possibility gives rise to the question whether the (observed) EM-frequency of the photon might change as drastically as time does.

'Frequency' is defined as the reciprocal value of 'period time'. The period time has become as zero as the time of the photon does. So the frequency of the (observed) EM-field in the photon has become infinite, leading to a situation that the photon is outside the visible spectrum/not visible anymore.

Or do we have to conclude that the length of the pulse, expressed in seconds, is zero, in which case the photon is neither visible. See chapter VIII for a detailed model of the photon.

It is up to the STR-defender to solve this dilemma.

Let us change the allocations of the two times, so suppose  $t$  belongs to the observer and  $t'$  to the photon and  $t' = t/\sqrt{(1-v^2/c^2)}$ .

Now the time  $t'$  in the photon is infinite, resulting in an EM-frequency of zero.

Again the photon is not visible and again the STR-defender has to solve this dilemma.

## Conclusion

A photon does have a velocity  $c$  relative to whichever observer, as the Special Theory of Relativity prescribes. As a result the time dilation formula eventually prescribes that a photon will not be visible for whichever observer. So no observer will observe light.

It is up to the STR-defender to decide what to do with this deadly contradiction with reality.

## References

- [1] [https://en.wikipedia.org/wiki/Time\\_dilation](https://en.wikipedia.org/wiki/Time_dilation)
- [2] <https://en.wikipedia.org/wiki/Spacetime>

## XVI No evidence for spinning electrons

*Summary - Otto Stern and Walter Gerlach demonstrated in 1922 experimentally the “existence of space quantization in a magnetic field”, using their own words. The result of this experiment is later on used to introduce the so-called intrinsic spin angular momentum of elementary and other particles. This article describes what went wrong in the applied argumentation. In 1896 Zeeman and Lorentz showed experimentally and theoretically that atoms emit ‘shifted’ frequencies when exposed to an external magnetic field. This phenomenon has been used to demonstrate the existence of spinning electrons. However, it is shown that this demonstration is not convincing at all. Besides that: which problems, created by physicists themselves, would be solved letting electrons to spin?*

### 1 Introduction

Even the quoted text from Stern and Gerlach in the summary already shows an imperfection: the words “angular momentum” don’t represent the real issue: an angular momentum is meant to express a pure mechanical property of the subject under consideration. What should have been written is “magnetic moment”. The origin of the so-called intrinsic spin angular momentum of elementary particles, hadrons and atomic nuclei has to be found in the Stern-Gerlach experiment. Quoted from [1]:

“Otto Stern and Walter Gerlach were carrying out experiments to demonstrate the existence of what they called Space Quantization in a Magnetic Field.” Although the authors focused upon the Space Quantization in a Magnetic Field the significance of the article has become that of the first evidence of the spin of electrons.”

Studying [1] leads to the conclusion that a large step has to be made to come from ‘Space Quantization in a Magnetic Field’ in order to end at ‘spin magnetic moment’ of electrons. This article describes what went wrong in making this large step.

Another phenomenon, called Zeeman-effect, has also been used to prove the existence of spinning electrons. This article shows why this supposed evidence is not valid.

### 2 Analysis of the Stern-Gerlach experiment

Stern and Gerlach realized an experiment schematically shown in figure 1, copied from [2]:

*‘silver atoms travel through an inhomogeneous magnetic field and are deflected up or down depending on their spin.’*

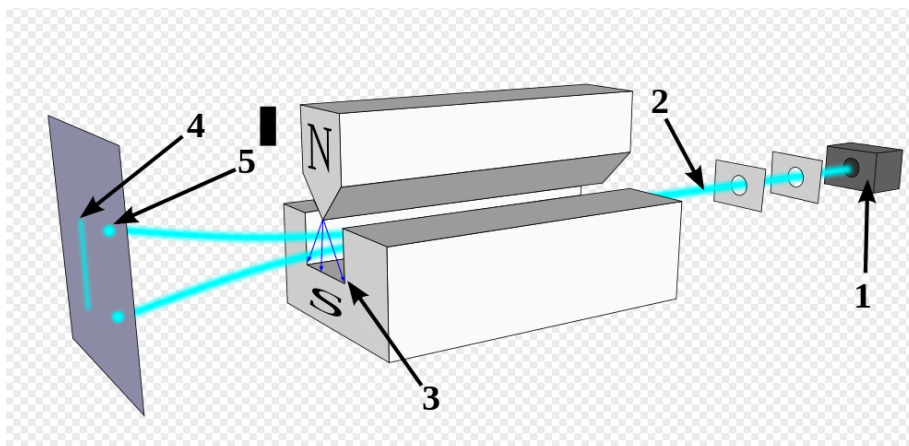


Figure 1 Schematic diagram of Stern-Gerlach experiment

1: furnace, 2: beam of silver atoms, 3: inhomogeneous magnetic field, 4: expected result, 5 what was actually observed.

Text copied from [2]:

“The results show that particles possess an intrinsic angular momentum that is closely analogous to the angular momentum of a classically spinning object, but that takes only certain quantized values.”

Comment:

This text shows another carelessness: “intrinsic angular momentum” on the one hand and “angular momentum of a classically spinning object” on the other hand.

Whatever is meant above, one should only use “angular momentum of an orbiting particle” and “angular momentum of a spinning particle”.

With the text from [2] the mentioned large step has already been made, without presenting any evidence of its correctness. The conclusion of Stern and Gerlach was: “We view these results as direct experimental verifications of space quantization in a magnetic field.” Whatever may be meant by these words, certainly not the above shown conclusion as presented by [2]. Besides the fact that one should have used ‘magnetic moment’ instead of ‘angular momentum’, the question arises why the *magnetic moment of orbiting*, not *spinning*, electrons has not been investigated as an explanation for the obtained result? And if it might have been investigated, why is the result of such an investigation not presented?

A silver atom contains 47 orbiting electrons. Each electron represents a circular shaped current that causes a magnetic field as symbolically shown in figure 2.

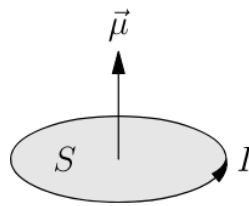


Figure 2

The symbol  $\vec{\mu}$  in vector notation is meant to express the *magnetic moment*  $I \times S$  of such a configuration. But the symbol  $H$  could also have been drawn there in order to express symbolically the magnetic field as a result of the equivalent current  $I$ .

This current equals  $q/t_0$ , with  $q$  the electrical charge of an electron and  $t_0$  the period time of the orbit.

If  $r$  is the radius of the orbit and  $m$  the mass of the electron, then the following relations can be presented:  $t_0 = 2\pi r/v$  and  $v = q(\kappa Z/mr)^{1/2}$ , with  $v$  the tangential velocity of the electron,  $Z$  the atom number and  $\kappa$  Coulomb’s constant  $1/4\pi\epsilon_0 \text{ Nm}^2\text{C}^{-2}$ . Given  $H = I/2r$  and  $I = qv/2\pi r$ , it follows that  $H = qv/4\pi r^2$ .

The importance of the variable  $H$  is that it wants to align with the direction of an external magnetic field as applied to the silver atoms in the Stern-Gerlach experiment.

The magnetic moment  $I \times S$  is the quantity that determines the torque the atom will experience in an external magnetic field when  $H$  is perpendicular oriented with respect to the direction of the external field. Given  $S = \pi r^2$ , the magnetic moment  $I \times S = qvr/2$ .

This is a remarkable result: while the magnetic field strength decreases as function of the radius, the magnetic moment increases! As shown by the equations, the surface enclosed by the orbit causes this effect.

Given these considerations the question now arises: what is, regarding this magnetic moment in the Stern-Gerlach experiment, the effect of 47 electrons orbiting the nucleus of the silver atom?

Suppose these electrons eventually generate a *net* magnetic field of whichever strength and with whichever direction with respect to the direction of an external field.

To copy the words of Stern and Gerlach: “In a second communication it was shown that the normal silver atom has a magnetic moment.” N.B. Stern and Gerlach used the right term here!

Given a bundle of silver atoms, created by the evaporation of (the metal) silver in a furnace, it is, in the following consideration, assumed that the atoms entering the external magnetic field are completely free to change the orientation of their *net* magnetic field without changing the orbits of their electrons. This means that each atom as a whole is assumed to rotate freely about any axis through its centre.

Whatever the *net* strength of the magnetic field of each atom individually might be, only the orientation of this field w.r.t. the orientation of the external field, at the moment the atom enters this external field, determines the direction of the rotation of the atom in order to get aligned with the external field. But eventually the magnetic field of all atoms will be oriented in such a way that their north pole points to the south pole of the external field, or expressed in the other way round. It is assumed that the rotation of the atoms takes place in such a short time that directly after it enters the external field this rotation will be completed. The end result is that the *net* magnetic field of each atom points in the opposite direction as the external field does. The atoms that are at the entrance closer to the north pole respectively south pole of the external field will be attracted by these respective poles. Because of their random position there, on average, half of the atoms will move up and the other half down. This perfectly explains the result of the measurements of the Stern-Gerlach experiment.

Up till now there is no reason to conclude that evidence of a “space quantization in a magnetic field” has been presented, whatever these words may mean physically.

Neither is there any evidence that only the supposed (intrinsic) *spin* of (all the orbiting) electrons in the beam of silver atoms is responsible for the obtained result.

In [1] it is stated:

“Stern and Gerlach worked with a beam of silver atoms but the effects were due to the valence electrons of the silver atoms so their beam was essentially a beam of massive electrons.”

This is not a logical conclusion, to put it mildly. There is no reason to assume that the evaporation leads to a detachment of an electron from the silver atom. But suppose they would do so and suppose only these separated electrons would cause the measured deflections, how do Stern and Gerlach’s words: *the layer of silver, deposited on the receiving plate*, as written in their remark below, have to be interpreted then?

“The “irradiation time” was stretched out to eight hours without interruption. But even after eight hours of vaporization, *the layer of silver, deposited on the receiving plate*, was so thin because of the very narrow apertures and the great length of the beam that, just as previously reported, it had to be developed.”

A layer of silver is not a layer of electrons, supposed such a layer can be created! And if it would be a layer of electrons, what happened with the silver *ions*?

### 3 The concept: intrinsic spin magnetic moment of a charged particle

It has been shown above that there is no reason to introduce the concept intrinsic spin magnetic moment of a charged particle based on the Stern-Gerlach experiment. On the contrary: it has been shown that, based on the results of this experiment, most likely silver atoms have, given their net magnetic moment due to their orbiting electrons, a fifty-fifty chance to be attracted by the north respectively south pole of the external field. The appendix shows an original drawing of this pattern, copied from [2].

Yet the spinning electron has been introduced. So the question is: how is this done, while there is no evidence of its existence at this moment.

Remark: The word ‘spinning’, from now on, will only be used to express ‘rotating around its own axis’, explicitly excluding the phenomenon “orbiting”.

Reference [3] shows the following description:

#### “Magnetic moment and angular momentum

The magnetic moment has a close connection with angular momentum called the gyromagnetic effect. This effect is expressed on a macroscopic scale in the Einstein-de Haas effect, or “rotation by magnetization,” and its inverse, the Barnett effect, or “magnetization by rotation.”[1] In particular, when a magnetic moment is subject to a torque in a magnetic field that tends to align it with the applied magnetic field, the moment precesses (rotates about the axis of the applied field). This is a consequence of the concomitance\* of magnetic moment and angular momentum, that in case of charged massive particles corresponds to the concomitance of charge and mass in a particle.”

\* to read as: going together

Comment:

The close connection between the magnetic moment and the angular momentum is effectively two times more repeated by means of the words: “the concomitance of magnetic moment and angular momentum”. The second time it is, without any physical explanation, applied to the supposed spinning of a charged particle, simultaneously suggesting that the ratio between charge and mass of such a spinning particle is an important parameter of the concept under consideration, again without any explanation.

The question arises why the mass of such a spinning charged particle would play any role in its supposed *magnetic* moment. If the particle would spin, it would have an angular momentum equal to the product of its inertial moment  $(2/5)mr^2$  ( $m$  is mass and  $r$  is radius of the particle, assumed to be shaped spherically) and its angular speed  $\omega = v/r$ , with  $v$  the tangential velocity of the spinning particle. So the angular momentum is  $(2/5)mvr$ .

The angular momentum of an orbiting mass  $m$  with tangential velocity  $v$  at a radius  $r$  is simply  $mvr$ .

Might it be that the resemblance of magnetic moment and angular momentum of an *orbiting* charged particle is misused, applying this to a supposed *spinning* charged particle?

The quotient ‘magnetic moment’  $(qvr/2)$  / ‘angular momentum’  $(mvr)$  of an *orbiting* charged particle is:  $q/2m$ . In case of a *spinning* (charged) particle its angular momentum is  $(2/5)mvr$ , as just shown above. But its magnetic moment still has to be determined. Although fully unacceptable from a scientific point of view, let us apply the ratio  $q/2m$  of an orbiting particle to a spinning charged particle. Then its magnetic moment would be  $q/2m \cdot (2/5)mvr = qvr/5$ . Nice to compare with the magnetic moment of an orbiting electron:  $qvr/2$ , but that’s all!

What has happened in the scientific literature regarding this phenomenon, assuming that reference [4] fulfils the criteria for “scientific literature”?

It presents the following description:

“In atomic physics, the Bohr magneton (symbol  $\mu_B$ ) is a physical constant and the natural unit for expressing the magnetic moment of an electron caused by either its orbital or spin angular momentum. The Bohr magneton is defined in SI units by ( $e$  replaced by  $q$  and  $m_e$  by  $m$ ):

$$\mu_B = q\hbar/2m \quad \text{Am}^2$$

where

$q$	is the elementary charge	C	= As
$\hbar$	is the reduced Planck constant	VAs <sup>2</sup>	= kgm <sup>2</sup> s <sup>-1</sup>
$m$	is the electron rest mass and	kg	”

followed by:

“The electron magnetic moment, which is the electron's intrinsic spin magnetic moment, is one Bohr magneton.”

Comment:

Mind the statement:

“... $\mu_B$  is a physical constant and the natural unit for expressing the magnetic moment of an electron caused by either its orbital or spin angular momentum”

However,  $\mu_B = q\hbar/2m$  is nothing more than the multiplication of the just calculated quotient ‘magnetic moment/angular momentum’  $q/2m$  of an *orbiting* electron with the constant  $\hbar$ , without any argumentation, so worthless from a scientific point of view.

The misleading text is that the magnetic moment would be caused by the angular momentum, because the correct text would have been: the magnetic moment of an *orbiting* electron is caused by its charge  $q$ , its tangential velocity  $v$ , and the radius  $r$  of its orbit. The magnetic moment of an orbiting particle is independent of the mass of that particle, but notwithstanding this fact the ratio  $q/2m$  is chosen as the basis of the proposed new unit for magnetic moment.

Claiming the “concomitance of magnetic moment and angular momentum, resembles the concomitance of charge and mass in a particle” and introducing the Bohr magneton unit  $q\hbar/2m$ , leads to the consequence that an orbiting electron has a magnetic moment of  $mvr \cdot q/2m = mvr \cdot q\hbar/2m / \hbar$  Am<sup>2</sup>. This can be written as  $mvr/\hbar \mu_B$ , instead of simply  $qvr/2$  Am<sup>2</sup>, showing the meaninglessness of  $\mu_B$ .

It is even misleading, because it suggests that the magnetic moment depends on the mass of the electron. So, still no theoretical physical evidence has been given at all about the magnetic moment of a spinning charged particle. Only a new, but not practical, unit for expressing ‘magnetic moment’ has been introduced.

Let us have a look at the description of the Einstein-de Haas effect. [5]

“The Einstein-de Haas effect is a physical phenomenon in which a change in the magnetic moment of a free body causes this body to rotate.”

Comment 1:

The words “magnetic moment” have to be angular momentum, but then at the same time it is not an Einstein-de Haas effect. Or the text has to be changed in: The Einstein-de Haas effect is a physical phenomenon in which a change in the magnetic moment of a free body *in an external magnetic field* causes this body to rotate. But this is the so-called Magnetic dipole–dipole interaction.

“The effect is a consequence of the conservation of angular momentum. It is strong enough to be observable in ferromagnetic materials. The experimental observation and accurate measurement of the effect demonstrated that the phenomenon of magnetization is caused by the alignment (polarization) of the angular momenta of the electrons in the material along the axis of magnetization.”

Comment 2:

In this text all the words “angular momentum” have to be changed in magnetic moment, as already suggested in comment 1. Secondly: the word “electrons” has to be changed in atoms.

“These measurements also allow the separation of the two contributions to the magnetization: that which is associated with the spin and with the orbital motion of the electrons.”

Comment 3:

This conclusion is, given the Stern-Gerlach experiment, not correct.

“The effect also demonstrated the close relation between the notions of angular momentum in classical and in quantum physics.”

Comment 4:

This conclusion is not correct either, as has been argued above.

Conclusion:

The description of the Einstein-de Haas effect causes a lot of confusion. No demonstration at all is given of the existence of a spinning electron and its magnetic moment.

The fundamental question is why the concept ‘angular momentum’ plays such an important role in all the descriptions? It is a pure mechanical property, having nothing to do with the magnetic moment!

Back to reference [3]:

“Viewing a magnetic dipole as a rotating charged particle brings out the close connection between magnetic moment and angular momentum. Both the magnetic moment and the angular momentum increase with the rate of rotation. The ratio of the two is called the gyromagnetic ratio and is simply the half of the charge-to-mass ratio.”

Comment:

Writing “viewing a magnetic dipole as a rotating charged particle” is putting physical science upside down. There are no problems in deducing the magnetic moment of a magnetic dipole. There are problems in demonstrating the existence of spinning charged particles and as a result their assumed magnetic moment. Therefore a better approach would be: Viewing a spinning charged particle as a magnetic dipole. However such an approach doesn’t help either to prove the existence of such a phenomenon.

## 4 Zeeman-effect: historical review

In order to fully understand the impact of Zeeman his famous experiment, leading to the expression ‘Zeeman-effect’, his scientific work has to be placed in a historical perspective. That history starts with Rydberg’s work on this area.

Copied from [6]:

*“Johannes (Janne) Robert Rydberg (8 November 1854 – 28 December 1919) was a Swedish physicist mainly known for devising the Rydberg formula, in 1888, which is used to predict the wavelengths of photons (of light and other electromagnetic radiation) emitted by changes in the energy level of an electron in a hydrogen atom.”*

Comment:

In 1888 Rydberg did not know about energy levels of electrons in atoms! He succeeded in finding a relation between the measured frequency of light emitted by hydrogen like atoms and a combination of two integers, expressed by:  $f = c \cdot R_{\infty} (1/n_1^2 - 1/n_2^2)$

Copied from [7]:

*“The Zeeman effect, named after the Dutch physicist Pieter Zeeman, is the effect of splitting a spectral line into several components in the presence of a static magnetic field.”*

Comment:

This discovery happened in **1896**. Six years later Lorentz and Zeeman got the Nobel Prize for the combination of Zeeman his experiment and Lorentz his theory behind it. In this theory the existence of small electrically charged particles had been postulated, called ‘ions’ at that time. In order to explain the result of Zeeman’s experiment they assumed that these ‘ions’ are (also) part of the atoms and that they are responsible, by means of ‘vibrations’, for the light emitted by the atoms.

N.B. Nothing indicates the existence of *spinning* electrons. The result of this experiment has been explained by only the existence of ‘vibrating’ electrons inside the atoms.

To resume: Rydberg observed *quantified* frequencies, Zeeman observed frequencies *in between* these ‘Rydberg frequencies’ by applying external magnetic fields and Lorentz explained Zeeman’s results by postulating ‘vibrating’ electrons inside the atom.

At that time the phenomenon ‘vibration’ was not defined in more detail.

Today one would wonder whether these vibrating electrons are orbiting or spinning electrons.

In the mean time it has generally been accepted, based on the atomic model of Bohr, presented in **1913**, that ‘Rydberg’s frequencies’ are generated by means of photons and that photons are generated by electrons jumping from an inner to an outer orbit in the atom. For a detailed description see chapter VIII, also indicating that the emitted frequencies are fully explained without any influence of possible spinning electrons.

## 5 Interpretation of the Zeeman-effect

The question thus is: what happens, and specifically why, with the frequency of light emitted by an atom, if an external magnetic field is applied to that atom?

It is important to realize that measurements have shown that the shifts in the ‘Rydberg frequency’ increases with an increasing strength of the external magnetic field. That pleads for the following explanation.

Given the model shown in chapter VIII it is likely that the external magnetic field influences the orbits of all the electrons around the nucleus of the atom, just like the orbit of such electrons determine the strength of the related internal field, based on the equation  $H = qv/4\pi r^2 \text{ A/m}$ , with  $q$  the electrical charge of the electron and  $v$  resp.  $r$  the tangential velocity along, resp. radius of the orbit of the electron.

Chapter VIII shows, based on the Rydberg formula, that the characteristics of the inner and the outer orbit, represented by the numbers  $n_1$  resp.  $n_2$  in this formula, determine the frequency of the emitted photon. So a change in one of the orbits, or in both orbits, will cause a change in that frequency. It can be considered as most likely that the smaller the change of the orbits, the smaller the change in frequency of that photon.



Due to the fact that the orbits are differently oriented in a 3-dimensional space, each orbit will be influenced by the external magnetic field in a different way. If all internal magnetic fields would align with the external field, all electrons would orbit in one and the same plane, which is assumed to be extremely unlikely.

In this way the result of Zeeman's experiment can be explained without using the phenomenon 'spinning electron'. Besides that: in which way might a spinning electron, subject to an external magnetic field, have influence on the emitted frequency, fundamentally caused by the change in orbit of that same electron? And also: why does a spinning electron seemingly not have any influence on the emitted frequency if no external magnetic field is applied?

Reference [7] also states:

*"Historically, one distinguishes between the normal and an anomalous Zeeman effect (discovered by Thomas Preston in Dublin, Ireland [2]). The anomalous effect appears on transitions where the net spin of the electrons is an odd half-integer, so that the number of Zeeman sub-levels is even. It was called "anomalous" because the electron spin had not yet been discovered, and so there was no good explanation for it at the time that Zeeman observed the effect."*

Comment:

The question is: Was the effect called "anomalous" because the electron spin had not yet been discovered, or was the electron spin introduced in order to try to explain unexpected effects? In general it can be stated that if a phenomenon is not understood, unexpected results will show up.

The introduction of the spinning electron, in order to explain the so-called anomalous Zeeman-effect, has in scientific literature led to a coupling of the orbital angular momentum and the spin angular momentum of the electron into a total angular momentum, presented as quantized angular momentum. As mentioned already in the first part of this article angular momenta do have a pure mechanical nature, having nothing to do with magnetic moment. As long as the supposed spin angular momentum of an electron has not been transformed into a magnetic moment in a scientifically accountable way, the coupling of the *magnetic* moments of the orbital and spinning electron is impermissible.

At the same time the introduction of spinning electrons is not necessary in order to understand, in principle, the frequency shifts in the situations under consideration.

But it has to be realized that the external magnetic field disturbs the multi 3-dimensional orbital configurations of the atom in such a complicated way that a full and accurate prediction of these shifts cannot be calculated, in spite of the now-a-days mathematical models. Besides that: what might, eventually, be the scientific purpose of such an experiment?

## Conclusions

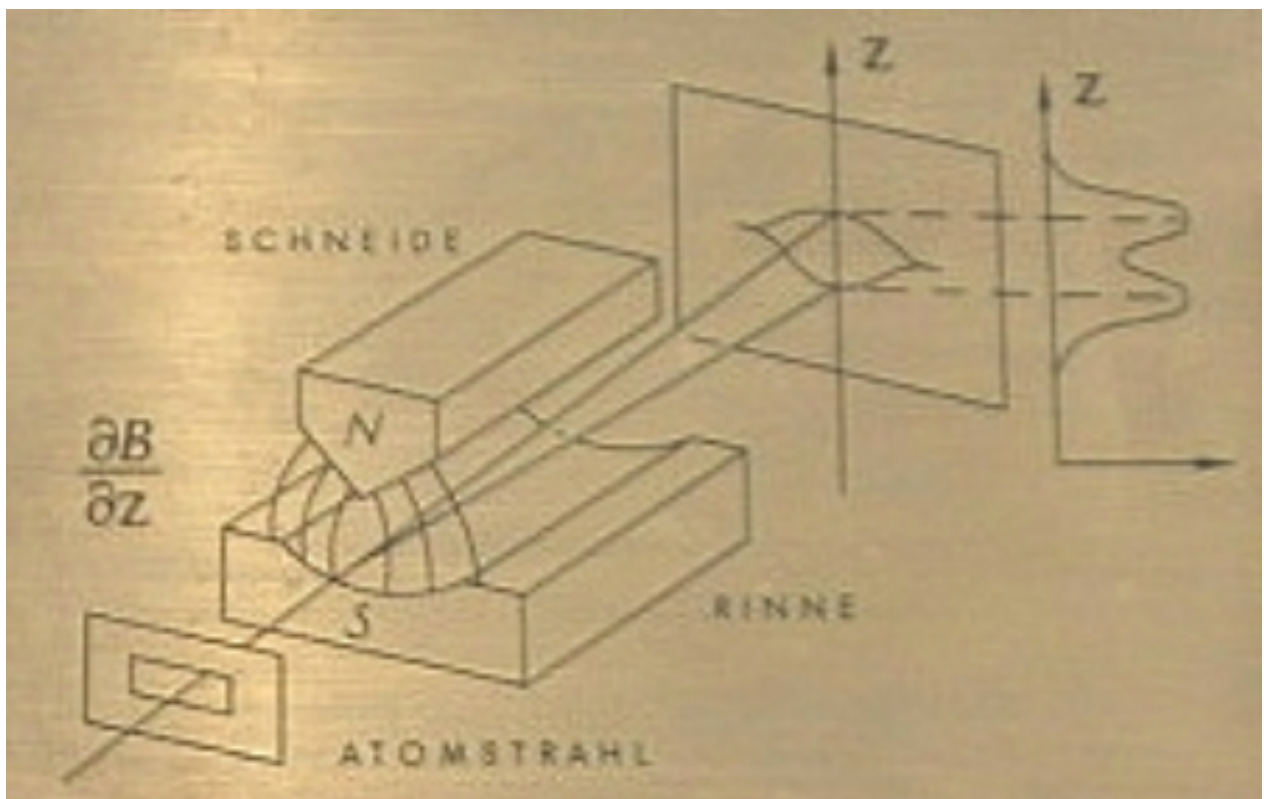
1. No evidence at all has been found in the Stern-Gerlach experiment for the existence of spinning charged electrons. The result of this experiment can be explained perfectly by means of the phenomenon: orbiting electrons in an atom, leading to the property of most likely all atoms: they are intrinsically magnetic dipoles.
2. The same conclusion has to be drawn regarding the supposed evidence of spinning electrons delivered by the Zeeman-effect: the observed shift in emitted frequencies, when atoms are exposed to an external magnetic field, is caused by a disturbance of the orbits of the electrons in the atoms.
3. In both experiments the results can be explained by applying the original atomic model of Bohr.
4. No mathematical / theoretical model of the *magnetic moment* of a supposed spinning charged particle has been found in scientific literature. Only the *unit* 'Bohr magneton' [ $\mu_B$ ] is presented, meant to express the magnetic moment dealing with orbiting or supposed spinning electrons.
5. Scientific literature shows a lot of confusing words about spinning charged particles, of which no one reveals what their magnetic moment might be.
6. In scientific literature much more attention is paid to the pure mechanical concept 'angular momentum' of supposed spinning charged particles than to, what is of course only relevant, the concept 'magnetic moment' of such particles.

## References

- [1] <http://www.applet-magic.com/sterngerlach.htm> ,  
San José State University, The translation of the article by Stern and Gerlach
- [2] [https://en.wikipedia.org/wiki/Stern-Gerlach\\_experiment](https://en.wikipedia.org/wiki/Stern-Gerlach_experiment)
- [3] [https://en.wikipedia.org/wiki/Magnetic\\_moment](https://en.wikipedia.org/wiki/Magnetic_moment)
- [4] [https://en.wikipedia.org/wiki/Bohr\\_magneton](https://en.wikipedia.org/wiki/Bohr_magneton)
- [5] [https://en.wikipedia.org/wiki/Einstein-de\\_Haas\\_effect](https://en.wikipedia.org/wiki/Einstein-de_Haas_effect)
- [6] [https://en.wikipedia.org/wiki/Johannes\\_Rydberg](https://en.wikipedia.org/wiki/Johannes_Rydberg)
- [7] [https://en.wikipedia.org/wiki/Zeeman\\_effect](https://en.wikipedia.org/wiki/Zeeman_effect)

## Appendix

Drawing shown at the plaque commemorating the experiment at the Frankfurt institute.



## **XVII Light in vacuum behaves like sound in air**

*Summary - At least, to the opinion of convinced supporters of the Special Theory of Relativity.*

### **1 Generally accepted properties of sound**

Sound has two fundamental properties: it doesn't propagate in vacuum and its propagation velocity, relative to a tangible medium, is determined by the properties of that medium and independent of the velocity, relative to that medium too, of its source.

### **2 STR properties of light**

Light has, according to the Special Theory of Relativity, two fundamental properties: it propagates (as well in certain tangible mediums as) in vacuum and its propagation velocity in vacuum is  $c$ , independent of the velocity of its source.

More specific regarding the vacuum:

Light has, according to the Special Theory of Relativity, two fundamental properties: it propagates in vacuum and its propagation velocity, relative to that vacuum, is  $c$ , independent of the velocity, relative to that vacuum too, of its source.

So indeed, light in vacuum behaves exactly like sound in air, *ignoring that vacuum means "nothing"*.

### **3 Experiments that prove the correctness of these properties**

Several experiments and measurements have been carried out, of which the results are used to claim the correctness of these properties.

A representative example is the observation of so-called (binary) pulsars.

Copied from Wikipedia:

"A pulsar is a neutron star that emits a beam of electromagnetic radiation. This radiation can be observed only when the beam of emission is pointing toward Earth (much the way a lighthouse can be seen only when the light is pointed in the direction of an observer), and is responsible for the pulsed appearance of emission."

The EM radiation seems to be noisy, so measuring any velocity by means of Doppler shifts is impossible. Only the time-spacings between the received pulses can be used. The parameters that have been determined are: the angular velocity of the spinning of the pulsar, the orbital velocity and radius of binary pulsars and the distance to earth.

N.B. The theoretical outcome of the time-spacings between the received pulses extremely depends on the chosen theoretical behaviour of light in vacuum.

The "scientific" work on pulsars, based on the STR, has been awarded with the Nobel Prize. To be qualified as "Nobel Prize for fun and fantasy".

The real property of light in vacuum is found in chapter I.

## XVIII The mystery of vacuum

*Summary - Given the magical statements in physics about the speed of light in vacuum it seems to be difficult to form an image of the propagation of light in vacuum.*

### 1 History

The very first impression of vacuum was the generally accepted idea that it contains an *intangible* medium in absolute rest, called ether, necessary for light to propagate through it.

The negative result of the experiment of Michelson and Morley led to the conclusion that such a property of vacuum could not be maintained anymore.

For that reason Einstein rejected this idea in 1905 and postulated:

“Any ray of light moves in the “stationary” system of co-ordinates with the determined velocity  $c$ , whether the ray be emitted by a stationary or by a moving body”, *in that ‘stationary’ system.* Note: The italicized text is added by the author.

By introducing the mysterious “stationary” system, Einstein effectively reintroduced the ether concept, without the property of being in absolute rest.

### 2 Clarification of the mystery

Imagine an infinite space of vacuum with only one object in it: a light source L.

Consider two situations: one in which L is stationary and one in which L is moving.

In normal life on Earth we don't have any problem distinguishing a moving object from a stationary object. We all unconsciously take the Earth as our reference system for that observation, but in vacuum this is impossible.

This lack of a reference system in an imagined space of vacuum can be confusing and is most likely responsible for the misunderstanding of the concept of light propagating in vacuum.

Suppose L is emitting a pulse P of light of a certain length. There are now two objects, L and P, in that infinite vacuum, of which the one moves relative to the other (with velocity  $c$ ). It will be more difficult to imagine that L moves with  $c$  relative to P than the other way round, but it is the reality.

Suppose a third object O, not having any influence on the behaviour of the emission of L, at an arbitrary distance from L and with an arbitrary velocity relative to L. Now we can determine whether L is a stationary or a moving body, *however only relative to O!*

Obviously such an object has no influence at all on the velocity between L and P. The unavoidable conclusion thus is that this velocity must be independent of the velocity of L, relative to whatever reference.

This conclusion inherently rejects Einstein's postulate.

### Acknowledgment

I'm grateful to my grandson Scott Uitterdijk (18 years young, enrolled in university and not hindered by any knowledge of electromagnetic radiation), who persistently kept on saying that one easily could distinguish a stationary body from a moving body in an infinite space of vacuum. Due to his attitude and the experiences of many discussions with physicists, I wrote this article.

## **XIX The umpteenth evidence**

*Summary - Having written several articles clearly proving the unsustainability of the Special Theory of Relativity, having informed by email almost 10000 physicists around the world about these evidences during the past 10 years and having published them at viXra, no progress at all has been obtained. That explains the background for the title of this chapter. Herein section 1 and 2 of Einstein's article about his STR have been scrutinized from a new point of view.*

### **1 Introduction**

Suppose there are two marks, A and B, in an infinite space of vacuum at a constant distance AB. Imagine a light ray, coming from a source at an arbitrary distance from A, passing A and B at the times  $t_A$  respectively  $t_B$ . The speed of *this light*, so in vacuum, on the trajectory AB is, by definition,  $AB/(t_B-t_A)$ . The reason for printing "*this light*" is that the velocity of light in vacuum is determined by its source! So each source in for example the universe does have its own velocity in universe. Fully opposite to Einstein's idea about this phenomenon! So let us have a look at Einstein's perception of such a situation.

### **2 Einstein's stationary system**

Einstein wrote his definition of a stationary system right at the beginning of section 1:

*"Let us take a system of co-ordinates in which the equations of Newtonian mechanics hold good (to the first approximation)."*

This vaguely defined system looks like what nowadays is called an inertial system. However Newtonian mechanics also include motions as a result of forces.

But Einstein's theory explicitly excludes such motions! So this description doesn't make sense.

*"In order to render our presentation more precise and to distinguish this system of co-ordinates verbally from others which will be introduced hereafter, we call it the 'stationary system' "*

It turns out that the systems "introduced hereafter" simply move with a constant speed, relative to this "stationary" system. So eventually Einstein only considers inertial systems.

He should simply have brought it as such, for example by means of the words "non-forced systems", if the concept "inertial systems" had not been introduced yet.

### **3 Einstein's thought experiments in his section 1**

He wrote in his article in 1905, copied from [1], from now on printed as italicized text:

*"We have so far defined only an 'A time' and a 'B time.' We have not defined a common 'time' for A and B, for the latter cannot be defined at all unless we establish by definition that the 'time' required by light to travel from A to B equals the 'time' it requires to travel from B to A. Let a ray of light start at the 'A time'  $t_A$  from A towards B, let it at the 'B time'  $t_B$  be reflected at B in the direction of A, and arrive again at A at the 'A time'  $t'_A$ . In accordance with definition the two clocks synchronize if  $t_B - t_A = t'_A - t_B$ ."*

This philosophy shows that Einstein fully rejects the possibility of a so-called common time for A and B, unless light travels the distance AB forth and back during the same time.

N.B. The light source is located in A, so his criterion in the last sentence is most trivial.

After a short consideration about 3 synchronously running clocks E. continues with:

*"Thus with the help of certain imaginary physical experiments we have settled what is to be understood by synchronous stationary clocks located at different places, and have evidently obtained a definition of "simultaneous," or 'synchronous,' and of 'time.' "*

Einstein seemingly considers simultaneous equivalent to synchronous, notwithstanding the fact that simultaneously simply means: at the same moment, while synchronously means: running with the same frequency/rate.

*The 'time' of an event is that which is given simultaneously with the event by a stationary clock located at the place of the event, this clock being synchronous, and indeed synchronous for all time determinations, with a specified stationary clock. In agreement with experience we further assume the quantity  $2AB / (t'_A - t_A) = c$ , to be a universal constant—the velocity of light in empty space."*

Here Einstein makes his first fundamental mistake: he defines  $c$  as the velocity of light in empty space resulting in an undefined velocity.

The background for this mistake is that he located the source in A (*Let a ray of light start ..... from A...*), but failed to mention this explicitly in his statement.

Einstein declares:

*"It is essential to have time defined by means of stationary clocks in the stationary system, and the time now defined being appropriate to the stationary system we call it 'the time of the stationary system' "*

One might wonder what might be essential in this declaration.

So at the end of section 1 Einstein hasn't brought up any new concept: simultaneously and synchronously were already well known and have not been changed. He declares clocks running synchronously by means of a most trivial criterion, and time is still time!

#### **4 Einstein's thought experiments in his section 2**

Einstein starts with the postulate:

*"Any ray of light moves in the 'stationary' system of co-ordinates with the determined velocity  $c$ , whether the ray be emitted by a stationary or by a moving body."*

Given the fact that he only considers a stationary light source in section 1, he now postulates, without any argumentation, that it doesn't matter whether this source is moving or not relative to the "stationary" system.

*"Hence velocity = light path / time interval, where time interval is to be taken in the sense of the definition in § 1."*

That means: measured by synchronously running clocks, located at the beginning and at the end of the related light path.

Einstein now introduces a moving rod, with a constant velocity  $v$  relative to the "stationary" system, defining the ends by means of A respectively B. He considers two methods to measure the length  $l$  of this rod:

- method "a" directly by means of a measuring rod in the moving system of the rod,
- method "b" by means of clocks and with help of a light ray in the "stationary" system.

*"The length to be discovered by the operation (b) we will call 'the length of the (moving) rod in the stationary system.' This we shall determine on the basis of our two principles, and we shall find that it differs from  $l$ ."*

With this statement he made the following fundamental mistake: if the length of the rod is  $l$ , as measured by method "a", and method "b" results in a value that differs from  $l$ , then the only correct conclusion is that method "b" has been carried out incorrectly.

The principle that all physical laws are the same in any inertial system forbids that the length of the rod changes in such situations. Effectively Galilei told us already 400 years ago too.

Einstein's following statement shows another inconsistency in his considerations.

*“Let a ray of light depart from A at the time  $t_A$ , let it be reflected at B at the time  $t_B$ , and reach A again at the time  $t'_A$ . Taking into consideration the principle of the constancy of the velocity of light we find that  $t_B - t_A = r_{AB}/c - v$  and  $t'_A - t_B = r_{AB}/c + v$ , where  $r_{AB}$  denotes the length of the moving rod—measured in the stationary system.”*

The inconsistency concerns the fact that he applies the Newtonian law of addition of velocities, while the end result of his theory forbids such an addition.

Besides that Einstein accepts velocities larger than  $c$  in one of the expressions above, while the outcome of his theory also forbids such velocities.

## 5 Back to the thought experiment in the Introduction

The situation sketched in the Introduction sounds:

Suppose there are two marks, A and B, in an infinite space of vacuum at a constant distance AB.

Imagine a light ray, coming from a source at an arbitrary distance from A, passing A and B at the times  $t_A$  respectively  $t_B$ . The speed of *this light*, so in vacuum, on the trajectory AB is, by definition,  $AB/(t_B - t_A)$ .

As Einstein wrote:  $t_B - t_A = r_{AB}/(c - v)$

With  $r_{AB} = AB$  resulting in:  $c - v = AB/(t_B - t_A)$ .

So the velocity of light in vacuum, emitted by a source having a relative speed  $v$  with respect to the marks A and B, equals  $c - v$  on the trajectory AB. *Effectively Einstein's own words!*

## Conclusions

1. Einstein introduced an undefined speed of light in empty space, by failing to define an unambiguous reference for this speed in such a space.
2. Einstein mixes up the real physical world and the measurement of it by insinuating that if the real length  $l$  of a rod is measured by an observer moving with constant velocity relative to the rod, this measurement will differ from that real length (“...we shall find that it differs from  $l$ .”). This is in contradiction to the principle that each physical law is the same in any inertial system.
3. Einstein accepts velocities larger than  $c$  at the basis of the creation of his theory, by applying the Newtonian law of addition of velocities, so by applying the ballistic theory of light in vacuum. This is in contradiction to the result of his theory.
4. Light rays in the universe reach the earth with velocity  $c + v$  relative to earth, with  $v$  the velocity of the source *at the moment of emission* relative to the velocity of the earth *at the moment of reception*, both projected on the direction of the light ray.

## Reference

- [1] Translated original article of Einstein:  
On the electrodynamics of moving bodies, By A. Einstein, June 30, 1905  
<http://www.fourmilab.ch/etexts/einstein/specrel/www/>

## XX What went wrong with the atomic mass unit

*Summary - The atomic mass unit (amu) has already been applied for more than 200 years. The problem is that the amu now-a-days has been defined in two different ways: the Newtonian one and the one based on modern physics by applying the magic energy  $mc^2$  and the magic atomic nuclear forces, interpreted as nuclear binding energy. This energy is posited as equal to  $mc^2$ , without any motivation and as such violating the law of mass conservation.*

### 1 Introduction

The atomic mass unit (amu) has changed four times over the past 200 years. After the existence of elemental isotopes was discovered, the atomic mass of the so-called naturally occurring oxygen divided by 16 has been introduced as the amu, replacing the mass of the atom divided by 16 of only  $^{16}\text{O}$ . The last change happened in 1961 when the mass of  $^{12}\text{C}$  divided by 12 was introduced. It is strange that it has not been realized in 1961 that  $^{12}\text{C}/12$  is exactly equal to  $^{16}\text{O}/16$ .

However, modern physics caused this confusion by introducing an amu based on *unbound* nucleons and an amu based on *bound* nucleons.

### 2 History of the amu

Ultimately the foundation of the amu is a combination of the neutron, proton and electron mass:

$$m_{\text{N}} = 1.674927471 \cdot 10^{-27} \quad m_{\text{P}} = 1.672621898 \cdot 10^{-27} \quad m_{\text{e}} = 9.10938356 \cdot 10^{-31} \quad \text{kg}$$

All these masses are claimed to have a relative uncertainty of  $10^{-10}$ !

The amu is a standard unit of mass that quantifies mass on an atomic or molecular scale. Reference [1] presents the following information under "History".

The first amu (1803) was  $^1\text{H}$ , being the mass of 1 proton plus 1 electron.

$$\text{amu}_1 = 1.673532848000 \cdot 10^{-27} \text{ kg}$$

The second amu (1903) was expressed in terms of units of  $1/16$  mass of oxygen. At that time the existence of elemental isotopes was not yet known, so it concerned  $^{16}_8\text{O}$  in present terms.

$$\text{amu}_2 = 1.674230153678 \cdot 10^{-27} \text{ kg}$$

The third amu (1929) was based on the total atomic weight of so-called naturally occurring oxygen, defined as  $99.757\% \ ^{16}\text{O} + 0.038\% \ ^{17}\text{O} + 0.205\% \ ^{18}\text{O}$ .

$$\text{amu}_3 = 1.674699139192 \cdot 10^{-27} \text{ kg}$$

The ratio  $\text{amu}_3/\text{amu}_2$  is indeed 1.00028 as [1] presents:

"The divergence of these values could result in errors in computations, and was unwieldy. The chemistry amu ( $\text{amu}_3$ ) was about 1.000282 as massive as the physics amu ( $\text{amu}_2$ ). For these and other reasons, the reference standard for both physics and chemistry was changed to carbon-12 in 1961. The new and current unit was referred to as the unified atomic mass unit "u", which replaced the now outdated "amu".

Despite this change, modern sources often still use the old term "amu" but define it as  $1/12 \ ^{12}\text{C}$ . Therefore, in general, "amu" likely does not refer to the old oxygen standard unit, unless the source material originates from the 1960s or before."

$$\text{amu}_4 = 1.674230153678 \cdot 10^{-27} \text{ kg}$$

All these (historical) values of the amu are expressed in current neutron, proton and electron masses.

As mentioned already,  $\text{amu}_4$  equals  $\text{amu}_2$  for the basic reason that  $^{12}\text{C}/12$  equals  $^{16}_8\text{O}/16$ .

For that same reason  $\text{amu}_4$  also equals  $(m_{\text{N}}+m_{\text{P}}+m_{\text{e}})/2$ , so referring to a certain element is not necessary. Hereinafter  $\text{amu}_4$  will be written as amu.



### 3 What went wrong with the amu

Reference [1] \* not only presents the information shown above. It starts as follows:

“It (amu) is defined as one twelfth of the mass of an *unbound* neutral atom of carbon-12 in its nuclear and electronic ground state and at rest, and has a value of  $1.660539040(20) \cdot 10^{-27}$  kg.”

N.B. Nothing in universe is at rest. An object can only be at rest relative to another object. So the restriction “and at rest” is a nonsense restriction.

A neutral atom is an atom with the same number of protons and neutrons.

“Ground state” is defined as the state of the atom where it has the lowest state of energy.

Due to the misunderstanding of the phenomenon “potential energy”, see chapter VII, the atom is defined to have the lowest energy state when its electrons orbit at their smallest radii. The opposite is true!

It turns out that the word “*unbound*” is misleading. A few sentences further in [1] one reads:

“For standardization a specific atomic nucleus (carbon-12 vs. oxygen-16) had to be chosen because the average mass of a nucleon depends on the count of the nucleons in the atomic nucleus due to mass defect.”

The phenomenon “mass defect” (MD) is explained in [2]:

“Mass defect = (*unbound* system calculated mass) – (measured mass of system)  
i.e. (sum of masses of protons and neutrons) – (measured mass of nucleus)”

An “unbound atom” is an atom not *chemically* bound to other atoms.

So the difference between the amu defined as  $(m_N + m_P + m_e)/2$  kg versus  $1.660539040 \cdot 10^{-27}$  kg is the MD as a result of the assumed so-called binding energy between the nucleons in the atomic nuclei. This is done by applying the unphysical relation (binding) energy =  $MD \cdot c^2$ . See chapter II.

The total mass of six *unbound* protons, neutrons and electrons is  $2.0090761844136 \cdot 10^{-26}$  kg, while these particles, *bound* in an  $^{12}_6\text{C}$  atom, are:

$$12 \times 1.660539040 \cdot 10^{-27} / 1.66053906660(50) \cdot 10^{-27} \text{ kg}^* = 1.9926468480 \cdot 10^{-26} / 1.992646879920 \cdot 10^{-26} \text{ kg.}$$

N.B. The ratio of these amus is  $1.00824498151 / 1.00824496536$ , being much larger than the, round 1960, unaccepted ratio  $\text{amu}_3/\text{amu}_2 = 1.00028$ .

The question is: where does the value  $1.660539040(20) \cdot 10^{-27} / 1.66053906660(50) \cdot 10^{-27} \text{ kg}^*$  come from?

Based on the definition of MD it has to be concluded that this amu is a result of measurements.

Just like as in the definition of “mass defect”, the mass of the electrons is ignored in [1] too:

“One unified atomic mass unit is approximately the mass of one nucleon (either a single proton or neutron.....)”

A remarkable fact has been observed: the ratio  $(m_N + m_P + m_e)/(m_N + m_P) = 1.00027$ , ‘about exactly’ equal to the ratio  $\text{amu}_3/\text{amu}_2 = 1.00028$ . The question: is that chance?, is therefore justified.

Another question is justified too: how has the “unbound system *calculated* mass, i.e. sum of masses of protons and neutrons”, as used in the definition of MD, been *calculated*?

Final questions. The conclusion must be that if an atom is broken up into *unbound* nucleons and electrons, universe has enlarged its total mass! How can a transformation of (binding) energy into mass be explained? Can heat energy also be transformed into mass?

\*

Reference [1] is automatically redirected to [3], possibly as of September 27, 2021, showing an amu/Da/u of  $1.66053906660(50) \cdot 10^{-27}$  kg.

## 4 Application of the real 'unbound' amu

The *real* mass in kg of an atom is expressed as:

$$M_a = Z(m_N + m_p + m_e) + \Delta N \cdot m_N$$

with:

Z the so-called atomic number, being the number of protons in the nucleus

N the number of neutrons in the nucleus

$$\Delta N = N - Z.$$

As shown above:  $\text{amu} = (m_N + m_p + m_e)/2$

so:  $M_a = 2 \cdot Z \cdot \text{amu} + \Delta N \cdot m_N$

resulting in:  $M_a/\text{amu} = 2 \cdot Z + \Delta N \cdot m_N/\text{amu}$

$M_a/\text{amu}$  by definition equals W, the atomic mass number.

### Conclusions

1. Modern physics causes at least confusion realizing the atomic mass unit, by assuming that nuclear binding energy represents mass, called mass-defect, via  $E=mc^2$ . Most likely it even causes a large error in the presented value of the amu.
2. Realistic physics shows, by means of a simple mathematical expression and using the real atomic mass unit, how the real atomic mass number has to be calculated.
3. Modern physics leads to magic outcomes and to confusions and problems, more than ever in most situations.

### References

- [1] [https://en.wikipedia.org/wiki/Unified\\_atomic\\_mass\\_unit](https://en.wikipedia.org/wiki/Unified_atomic_mass_unit)
- [2] [https://en.wikipedia.org/wiki/Binding\\_energy#Mass\\_change](https://en.wikipedia.org/wiki/Binding_energy#Mass_change)
- [3] [https://en.wikipedia.org/wiki/Dalton\\_\(unit\)](https://en.wikipedia.org/wiki/Dalton_(unit))

## XXI Avogadro constant not in accordance with atomic mass unit

*Summary - In May 2019 a new value for the Avogadro constant has been introduced. However its proposed value is not in accordance with the value of the atomic mass unit, whichever one is taken: the one based on normal mass values, or on mass values influenced by binding energies in atomic nuclei, via  $E(\text{nergy}) = mc^2$ . This chapter presents an alternative approach.*

### 1 Introduction

In chapter XX it is shown how the value of the atomic mass unit (amu) is influenced by the binding energy in the nuclei of atoms. Reference [1] shows the history of the Avogadro constant.

(This text has been copied before the introduction of the new value of the constant!)

It concludes with:

“Pending revisions in the base set of SI units necessitated redefinitions of the concepts of chemical quantity. Avogadro's number, and its definition, was deprecated in favor of the Avogadro constant and its definition. Based on measurements made through the middle of 2017 which calculated a value for the Avogadro constant of  $N_A = 6.022140758(62) \times 10^{23} \text{ mol}^{-1}$ , the redefinition of SI units is planned to take effect on 20 May 2019. The value of the constant will be fixed to exactly  $6.02214076 \times 10^{23} \text{ mol}^{-1}$ .”

### 2 Presentation of contradictions

Reference [1] shows:

“A much simpler definition is that Avogadro's constant is the conversion factor for converting grams to atomic mass units.”

Reference [2] \* shows the history of the atomic mass unit (amu) and starts as follows:

“It (amu) is defined as one twelfth of the mass of an unbound neutral atom of carbon-12 in its nuclear and electronic ground state and at rest, and has a value of  $1.660539040 \cdot 10^{-27} \text{ kg}$ .”

The consequence of this value of the amu is that the atomic weight of  $^{12}\text{C}$  is not 12, but 12.011 amu. See reference [2] under Examples:

“A conventional value for standard atomic weight of carbon is 12.011 u (12.011 Da).“

Applying these values to the reference element  $^{12}\text{C}$  results in the following table:

atomic weight $^{12}\text{C}$	12.011	amu
amu	$1.660539040 \cdot 10^{-27}$	kg
atomic weight $^{12}\text{C}$	$1.994473441 \cdot 10^{-26}$	kg
12 gram $^{12}\text{C}$ has	$6.016256184 \cdot 10^{23}$	atoms

Remarks:

The atomic weight of C in kg is the product of the first two values in the table above.

12 gram C has  $0.012 \text{ (kg) / atomic weight of C (kg)} = 6.016256184 \cdot 10^{23}$  atoms.

The deviation from the value that has been introduced in May 2019 is significant: -0,09%.

One of the reasons of such a contradiction is described in the previous chapter. It shows that the value of the amu has been changed from  $1.674230153678 \cdot 10^{-27}$  to the above mentioned value  $1.660539040 \cdot 10^{-27} \text{ kg}$  based on the alleged influence of the so-called binding energy in a nucleus.

The previous value of the amu ( $1.674230153678 \cdot 10^{-27} \text{ kg}$ ) was  $(m_N + m_P + m_e) / 2$  with:

$$m_N = 1.674927471 \cdot 10^{-27} \quad m_P = 1.672621898 \cdot 10^{-27} \quad m_e = 9.10938356 \cdot 10^{-31} \quad \text{kg}$$

being masses not influenced by binding energies.

\*

Reference [2] is automatically redirected to [3], possibly as of September 27, 2021, showing an amu/Da/u of  $1.66053906660(50) \cdot 10^{-27} \text{ kg}$ .

If the same table is made with this amu, the result is:

atomic weight $^{12}_6\text{C}$	12	amu
amu	$1.674230154 \cdot 10^{-27}$	kg
atomic weight $^{12}_6\text{C}$	$2.009076184 \cdot 10^{-26}$	kg
12 gram $^{12}_6\text{C}$ has	$5.972894454 \cdot 10^{23}$	atoms

Again the deviation from the value that has been introduced in May 2019 is enormous: -0.8 %

### 3 Alternative amu and Avogadro constant based on alternative model of neutron

In chapter XXIII an alternative model of the atomic *nucleus* is proposed, based on the model of the neutron as a proton around which an electron orbits at a much smaller distance from the proton than is modelled in the hydrogen *atom*  $^1_1\text{H}$ .

In this model the mass of a neutron equals the mass of a proton plus an electron, while presently this mass is presented as the mass of a proton plus 2.531 times the mass of an electron.

Neglecting the influence of binding energy the amu would change from  $(m_N+m_P+m_e)/2$  to  $m_P+m_e$

The related value for the amu is  $1.6735328364 \cdot 10^{-27}$  kg. The tables presented above now become as follows:

atomic weight $^{12}_6\text{C}$	12	amu
amu	$1.6735328364 \cdot 10^{-27}$	kg
atomic weight $^{12}_6\text{C}$	$2.0082394036 \cdot 10^{-26}$	kg
12 gram $^{12}_6\text{C}$ has	$5.9753832030 \cdot 10^{23}$	atoms

Reference [1] writes:

“For instance, to the first order approximation, 1 gram of hydrogen element (H), having the atomic (mass) number 1, has  $6.022 \times 10^{23}$  hydrogen atoms. Similarly, 12 grams of  $^{12}\text{C}$ , with the mass number 12 (atomic number 6), has the same number of carbon atoms,  $6.022 \times 10^{23}$ ”

Mind the words: “*to the first order approximation*”!

Applying the alternative model for the neutron and for the atomic nucleus results in the table below:

atomic weight $^1_1\text{H}$	1	amu
amu	$1.6735328364 \cdot 10^{-27}$	kg
atomic weight $^1_1\text{H}$	$1.6735328364 \cdot 10^{-27}$	kg
1 gram $^1_1\text{H}$ has	$5.9753832030 \cdot 10^{23}$	atoms

### 4 Summarized results of the alternative approach

1. The alternative amu is  $1.6735328364 \cdot 10^{-27}$  kg, in case a neutron is assumed to be a proton and an orbiting electron at a much shorter distance from the proton than in an  $^1_1\text{H}$  *atom*.
2. The atoms of element  $^{Z+N}_Z\text{E}$  have a mass number of exactly  $(Z+N)$ , with Z the so-called atomic number, being the number of protons + electrons and N the number of neutrons, a neutron also being a proton + an electron in the alternative model of the atom.
3. The alternative Avogadro constant is  $5.9753832030 \cdot 10^{23}$  mol<sup>-1</sup>, resulting in:  $(Z+N)$  gram of the element  $^{Z+N}_Z\text{E}$  contains  $5.9753832030 \cdot 10^{23}$  atoms.

### References

[1] [https://en.wikipedia.org/wiki/Avogadro\\_constant](https://en.wikipedia.org/wiki/Avogadro_constant)

[2] [https://en.wikipedia.org/wiki/Unified\\_atomic\\_mass\\_unit](https://en.wikipedia.org/wiki/Unified_atomic_mass_unit)

[3] [https://en.wikipedia.org/wiki/Dalton\\_\(unit\)](https://en.wikipedia.org/wiki/Dalton_(unit))

## XXII Why Heisenberg-Schrödinger's atomic model is invalid

*Summary - Outstanding surprisingly the misconception regarding the phenomenon potential energy most likely caused the change from Rutherford-Bohr's to Heisenberg-Schrödinger's atomic model.*

### 1 Introduction

In the past 100 years, physics has become a science that is no longer comprehensible and must have led to the most exotic, widely divergent views and at least 100 unsolved problems, created by physicists themselves. This chapter draws attention to this result on the basis of a critical look at the atomic models.

### 2 Atomic models

#### 2.1 Rutherford-Bohr model

The most common objection against Bohr's atomic model is found in the words below, copied from Internet sources.

“Electrons that gained energy would jump to higher energy levels and become "excited", and as they jumped back down to the ground state, they would emit that energy. However, this model worked well for only the simple Hydrogen atom. Although this model is now considered obsolete, it is still used to showcase basic understanding of the structure of an atom.”

“The Bohr model depends on a connection between the frequency of light and the energy of the level change. If light of a frequency, corresponding to the energy change, interacts with the atom, the electron can absorb the light and jump up a level. If an excited electron jumps down a level, it loses energy. The energy the electron loses becomes light with a frequency corresponding to a change in energy.”

The common bewildering misconception in these words is the conception that electrons in larger orbits contain more energy than in lower orbits. This misconception has clearly led to the rejection of Bohr's model and to the search for "better" models.

Chapter VII shows in detail the evidence of what is just qualified as “misconception”. This evidence will be summarized below.

Potential energy can mathematically be represented by  $E_p = \int F(r) dr$ , with  $F(r)$  a force along a yet to be defined path. The background for this mathematical model is that potential energy is defined as the work-to-be-done to separate two objects from each other in case these objects attract each other. For example: bring a mass to a larger height relative to earth. The fundamental question is: has such energy to be considered as positive or as negative? In the chosen situation it would be strange to imagine such energy as negative, because it actually requires work to separate the mass from the earth.

In this example  $F(r) = C/r^2$ , so  $\int F(r) dr = -C/r^{\infty} = -C(1/\infty - 1/r) = C/r$ , with  $r$  the initial distance between the both masses. This result is fully in line with the previous reasoning. The smaller this initial distance  $r$  is the more energy it takes to increase the distance between the objects.

*Notwithstanding this most logical argumentation, potential energy is, since time immemorial, calculated as negative, by taking the lower boundary as  $\infty$  and the upper boundary as  $r$ .*

Chapter VII shows that in case of an orbiting electron the absolute value of its potential energy, so avoiding the problem of its sign, equals 2 times its kinetic energy. If the sign of the potential energy were now taken as negative, the total energy of the electron would become negative.

A physical law says that the centripetal force equals the centrifugal force all the way along a perfect circular orbit. As a result, the larger the radius of an orbiting electron, the lower its orbital velocity, so its kinetic energy, because the larger the distance between electron and nucleus the smaller the Coulomb/centripetal force between these two. Following the generally accepted argumentation, an electron orbiting at a larger radius has a lower kinetic energy, but added to a negative potential energy (that equals in absolute terms two times this kinetic energy) results in a total energy that is less negative. Seemingly that is qualified as higher energy. A most absurd argumentation.

As a result of this misconception the text below, copied from Wikipedia, has been generally accepted and has led to the wish to look for a better atomic model than the one of Bohr.

The wrong words have been crossed out and replaced by the correct ones.

**“Orbital energy**

In atoms with a single electron ....., the energy of an orbital ..... is determined exclusively by  $n$ . The  $n=1$  orbital has the ~~lowest~~ *highest* possible energy in the atom. Each successively higher value of  $n$  has a ~~higher~~ *lower* level of energy, but the difference decreases as  $n$  increases. For high  $n$ , the level of energy becomes so ~~high~~ *low* that the electron can easily escape from the atom.”

Especially the last sentence makes sense, after the correction, because it is well known that the atoms of conductive materials have so called valence electrons in the most outer orbits, which “can easily escape from the atom.” Sure thing, the higher the energy of an orbiting object the more energy it needs to get it out of its orbit. Or the other way round: imagine a planet at a very large distance from the sun. You only have to blow to get it out of its orbit.

A much more important conclusion is that the phenomenon potential energy does not play any role in an orbiting system. The background for this remark is the following. The centripetal and centrifugal forces, applied to the orbiting electron, are fully and continuously in balance due to the perfect circular orbit. The only phenomenon that really contains mechanical energy is its kinetic energy. This kinetic energy causes that the potential energy of the atom is not relevant anymore in the changes of energy state of the atom. Therefore from now on only the kinetic energy of the electron is taken as the mechanical energy of the atom.

Chapter VIII describes in deep detail, based on Bohr’s atomic model, how a photon is generated. The energy sources and changes are summarized below.

The energy of an emitted photon equals the change in kinetic energy of an electron jumping from an inner to an outer orbit. The first impression is that after such an emission the description of the energy exchange between the atom and its environment is completed. However this description is not complete.

In an orbital configuration, *only based on gravitational forces*, where an orbiting mass is forced to a larger orbit, the total loss of energy in such a system equals  $\Delta E_k = \frac{1}{2}m(v_1^2 - v_2^2)$  and concerns only *mechanical* energy, because there is no other source of energy in such a system.

If in such a system the orbiting mass is forced to an inner orbit, by definition by the environment, this system itself gains energy. This energy is delivered by the environment, because it carried out work to do so. If the environment carries out work to force this mass to an outer orbit, the system loses energy and it is tempting to simply argue that this energy is absorbed by the environment. However the environment carried out work to do so, thus must have *lost* instead of gained energy. The solution to this apparent contradiction is that the environment necessarily did already have an energy relation with the system before it could apply its force to it. Just like it also had in the first mentioned situation. The modelling of such an interaction requires at least a detailed knowledge of the specific interaction. But, at the end of the day we don’t need to model such an interaction, because only the final result regarding the system under consideration is relevant. The physical law of conservation of energy tells us that energy cannot be lost or gained, but only transferred.

In the orbital configuration of an electron in an atom the total loss of *mechanical* energy of the atom also equals  $\Delta E_k$ . But besides that it also loses an amount of energy equal to  $\Delta E_k$ , taken away by the energy of the emitted photon. Chapter VIII shows that this energy is delivered by the magnetic energy of the atom, generated by the orbiting electron, because such an electron is equivalent to a rotating electric current that creates a magnetic field.

Finally: what happens if the environment forces an electron to jump to an inner orbit?

The related atom will gain mechanical as well as magnetic energy in such a situation. However the presented model assumes the generation of a photon if a magnetic field, created by such an orbiting electron, *suddenly* changes. Indeed, the word “suddenly” is of crucial importance!

The problems that arose with this atomic model, most likely indirectly as a result of the misconception about potential energy, were tried to eliminate with "refined" models!

## 2.2 Heisenberg-Schrödinger model

Copied from [1]:

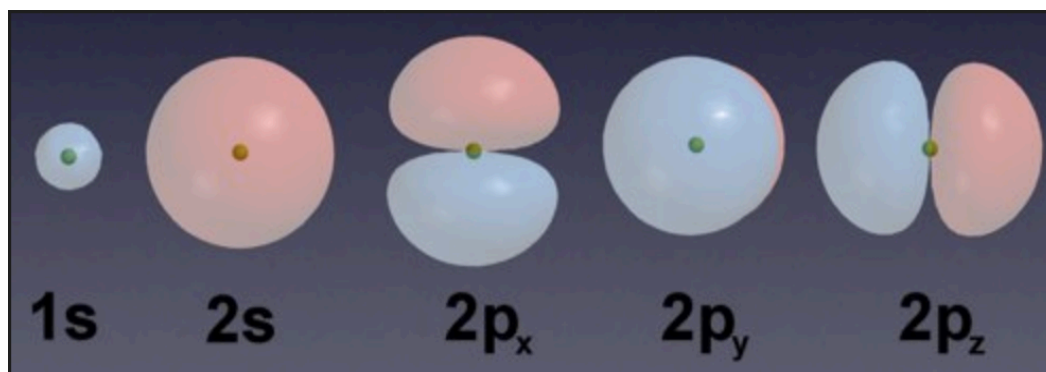
“In 1926 Erwin **Schrödinger**, an Austrian physicist, took the Bohr atom model one step further. Schrödinger used mathematical equations to describe the likelihood of finding an electron in a certain position. This atomic model is known as the quantum mechanical model of the atom. Unlike the Bohr model, the quantum mechanical model does not define the exact path of an electron, but rather, predicts the odds of the location of the electron. This model can be portrayed as a nucleus surrounded by an electron cloud. Where the cloud is most dense, the probability of finding the electron is greatest, and conversely, the electron is less likely to be in a less dense area of the cloud. Thus, this model introduced the concept of sub-energy levels.”

Copied from [2]:

“One of his most memorable discoveries of **Heisenberg** is the Uncertainty Principle. He said this means that electrons do NOT travel in neat orbits. Also, all electrons that contain photons will then change momentum and physics. Heisenberg 's contribution to the atomic theory was that he calculated the behaviour of electrons, and subatomic particles that also make up an atom. Instead of focusing mainly on scientific terms, this idea brought mathematics more into understanding the patterns of an atom's electrons. Heisenberg 's discovery helped clarify the modern view of the atom because scientists can compare the actually few numbers of atoms there are, by their movements of electrons, and how many electrons an atom contains. Surrounding the outside of an atomic nucleus is an electron cloud, which is a name given to the electrons that are widely spreading and moving around. In conclusion, Heisenberg contributed to the atomic theory by including quantum mechanics, the branch of mechanics, based on quantum theory, used for interpreting the behaviour of elementary particles and atoms.”

*That appears like the argumentation has been: the more vagueness the better the understanding!*

A picture of the related electron configuration, copied from Internet, is shown below.



The shapes of the electron clouds give the impression that electrons can also move right through the nucleus! Or, expressed in terms applied to describe this H-S atomic model: the H-S model also “predicts the odds that the location of the electron” is inside the nucleus.

Notwithstanding the minimum chance that such a model has anything to do with reality, it will nevertheless be further analysed on the basis of the corresponding electron configuration.

### 3 Electron configuration

The “modern” electron configuration has an intricate patron, but the basic idea is still the one used in the Rutherford-Bohr model [3]:

“Each shell can contain only a fixed number of electrons. The general formula is that the  $n^{\text{th}}$  shell can in principle hold up to  $2(n^2)$  electrons.”

However, these shells itself have been divided into subshells in the Heisenberg-Schrödinger model, making the configuration exceedingly complex:

“Each shell is composed of one or more subshells called s, p, d and f, which are themselves composed of atomic orbitals.”

The following very principle questions now arise:

- How can an electron orbit (inside these shells) if there is no proton in these shells?
- Why have these sub-shells, with these magically orbiting electrons, been introduced?
- What kind of problem do these sub-shells solve?
- If the first shell has only one sub-shell, why has that sub-shell been introduced?
- What do the electrons in this first shell in the H and He atom, besides just orbiting the nucleus?
- Or don't they just orbit the nucleus?

An answer to the question: “What kind of problem do these sub-shells solve?” might be:

*Hide the problem of the energy levels in the atomic model.*

### 4 Wave–particle duality

This duality plays a big role in the creation of quantum physics.

Reference [4] writes:

“Wave–particle duality is the concept in quantum mechanics that every particle or quantum entity may be partly described in terms not only of particles, but also of waves. It expresses the inability of the classical concepts "particle" or "wave" to fully describe the behaviour of quantum-scale objects. As Albert Einstein wrote:

It seems as though we must use sometimes the one theory and sometimes the other, while at times we may use either. We are faced with a new kind of difficulty. We have two contradictory pictures of reality; separately neither of them fully explains the phenomena of light, but together they do.”

Einstein introduced the “particle-wave-duality” that later has been upgraded to a kind of theory.

The weirdest result of that “theory” is the idea that an electron is not only a particle, but also a wave. Whatever that physically may mean.

### 5 QED model

Copied from [5]:

“Quantum electrodynamics (QED) is a theory which deals with the quantisation of the electromagnetic field, rather than focusing on individual particles in isolation, and this predicts several corrections to the *electron energy*. “

Comment:

This model is created while the phenomenon *electron energy* was, and is still, fundamentally misunderstood!

*Notwithstanding* these most exotic models reference [6] shows a list of at least 100 unsolved problems in physics, “grouped into broad areas of physics.”

Or would the formulation “*as a result of* these most exotic models” be more appropriate?



## Conclusions

- 1 It is considered outstanding surprising that the misconception regarding the phenomenon “potential energy” most likely has led to the rejection of the Rutherford- Bohr model and to the creation of the Heisenberg-Schrödinger model, creating many more unsolved physical problems than solutions.
- 2 With the Rutherford-Bohr model and the correct calculation of potential energy, the generation of a photon can perfectly modelled, without applying any kind of quantum physics.
- 3 The general comment on Chapter VIII: “Why a Photon is not a Particle” is:  
Not valid, because it doesn’t use the QED model of the atom!  
The question is: How to break through this circle argumentation?  
The answer is: Repair the wrong definition of potential energy into the correct one.

## Encore

Quote:

Wave–particle duality is the concept in quantum mechanics that every particle or quantic entity may be partly described in terms not only of particles, but also of waves. It expresses the inability of the classical concepts "particle" or "wave" to fully describe the behaviour of quantum-scale objects.

Unquote

When a phenomenon is “explained” by a duality or paradox, the reality is that such a phenomenon is not understood and thus cannot be modelled. Upgrading such a duality or paradox to a “theory” is almost the worst a scientist can do. The worst he can do is to apply such ignorance to a well-understood phenomenon (for example: an electron is an electric charged real particle) and come up with a phenomenon that doesn’t make sense at all.

Physical science should not accept judgements like duality and paradox, but solve them without switching to magic physics.

## References

- [1] [http://www.abcte.org/files/previews/chemistry/s1\\_p6.html](http://www.abcte.org/files/previews/chemistry/s1_p6.html)
- [2] <https://the-history-of-the-atom.wikispaces.com/Werner+Heisenberg>
- [3] [https://en.wikipedia.org/wiki/Electron\\_shell](https://en.wikipedia.org/wiki/Electron_shell)
- [4] [https://en.wikipedia.org/wiki/Wave-particle\\_duality](https://en.wikipedia.org/wiki/Wave-particle_duality)
- [5] <http://cronodon.com/Atomic/AtomTech2.html>
- [6] [https://en.wikipedia.org/wiki/List\\_of\\_unsolved\\_problems\\_in\\_physics](https://en.wikipedia.org/wiki/List_of_unsolved_problems_in_physics)

## XXIII Atomic nuclei modelled without exotic particles and magic forces

*Summary - This article proposes a revolutionary solution for the repulsive forces in atomic nuclei by modelling a neutron as a proton around which an electron is orbiting at extremely short ranges. The protons, determining the atomic number of the element, at their turn are supposed to orbit such neutrons at a much larger orbit. This alternative neutron (newtron) represents energy densities up to 70 TJ/kg, consistent with published atomic bomb values. The newtron can generate (nuclear) photons along the same principle as (atomic) photons: by assuming electrons to jump from an inner to an outer orbit. The enormous energy of these electrons can create N-photons with electromagnetic field frequencies in the range  $10^{16}$ - $10^{24}$  Hertz. It has been shown that these frequencies obey the law  $E^2 = \eta f$ , with  $\eta = 4.5 \cdot 10^{-51}$  J<sup>2</sup>s. Their 'durations' are calculated as  $44/f$  seconds. Both constants are built up of universal constants. The newtron is also intended to replace the current theory, with which the mass of an elementary particle is determined by applying  $m = E/c^2$ . It creates an almost infinite number of particle types, all having the same energy density:  $E/m = c^2 = 90$  PJ/kg! The nuclear reactions in Sun's core and the values of its variables can easily be explained by applying this newtron.*

### Introduction

The author asked himself the question whether the introduction of the exotic particles called quarks are indeed necessary to hold neutrons and protons in atomic nuclei together, given the enormous repulsive forces between protons. On their turn these quarks need even more exotic particles, called gluons, to hold them together in these protons and neutrons. Such a solution appears to create more problems than solutions for the original problem.

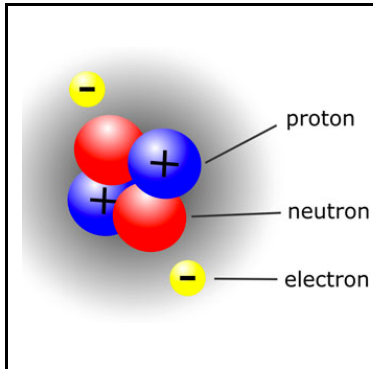
### Contents

- 1 Generally accepted configuration of the Helium nucleus
- 2 Solution of modern physics to prevent the 'explosion' of nuclei
- 3 Electron-Proton paradox
- 4 Philosophy about an alternative solution for the 'explosive' nucleus
- 5 Investigation of the feasibility of the alternative atomic nucleus model
- 6 Philosophy about orbiting electrons and emitting EM pulses
- 7 Comparison of theoretical energy densities with practical values
- 8 Nuclear photon until Yotta Hz instead of elementary particle
- 9 Calculation of the frequency and pulse length of nuclear photons
- 10 Contemplations about nuclear reactions
- 11 Nuclear fusion reactions in Sun's core

Conclusions

# 1 Generally accepted configuration of the Helium nucleus

The nucleus of the Helium atom is normally drawn as a combination of two protons and two neutrons grouped together as close as possible. See figure below, being one of a countless number of similar representations.

	Important parameter values			
	Parameter	Name	Value	Unit
	Atomic number	Z	2	NA
	Electric charge electron	q	$1,6 \cdot 10^{-19}$	C
	Electric charge proton	q	$1,6 \cdot 10^{-19}$	C
	Coulomb's constant	$k_e$	$9 \cdot 10^9$	$\text{Nm}^2\text{C}^{-2}$
	Gravitational constant	G	$6,7 \cdot 10^{-11}$	$\text{Nm}^2\text{kg}^{-2}$
	Mass proton	$m_p$	$1,7 \cdot 10^{-27}$	kg
	Mass neutron	$m_N$	$1,7 \cdot 10^{-27}$	kg
	Mass electron	$m_e$	$9,1 \cdot 10^{-31}$	kg
	Radius proton	$r_{\text{ptron}}$	$8,7 \cdot 10^{-16}$	m
	Radius neutron	$r_{\text{ntron}}$	$8,7 \cdot 10^{-16}$	m

The possible radii of the orbiting electrons are represented by  $r_n = n^2 a_0 / Z$ , with n is an integer and  $a_0$  the so-called Bohr radius:  $a_0 = \hbar^2 / (4\pi^2 \kappa q^2 m_e)$ ,  $\hbar = 6,626 \cdot 10^{-34} \text{ kg m}^2 \text{ s}^{-1}$ .

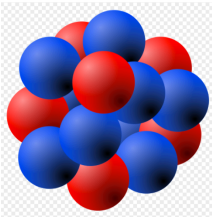
Variables following from these parameters are:

Parameter	Name	Value	Unit
Smallest radius of Helium atom	$r_1$	$2,7 \cdot 10^{-11}$	m
Centripetal force between orbiting electron and nucleus	$\kappa Z q^2 / r_1^2$	$6,6 \cdot 10^{-7}$	N
Centrifugal force electron	$m_e v^2 / r_1$	$6,6 \cdot 10^{-7}$	N
Orbital velocity of electron ( $v = q\sqrt{(\kappa Z / m_e r_1)}$ )	v	$4,4 \cdot 10^6$	m/s
Radius of grouped protons and neutrons (approximately)	$r_{\text{ncls}}$	$2 \cdot 10^{-15}$	m
Repulsive force $F_C$ between protons ( $\approx \kappa q^2 / r_{\text{ncls}}^2$ )	$F_C$	$2 \cdot 10^2$	N
Gravitational force $F_G$ between protons or neutrons ( $\approx G m_N m_P / r_{\text{ncls}}^2$ )	$F_G$	$10^{-34}$	N

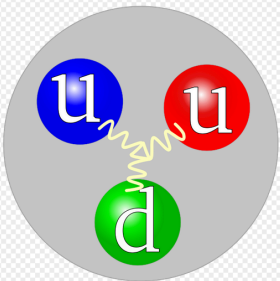
Preliminary conclusions: gravitational forces don't play any role; the radius of the atom is about 30 thousand times larger than the radius of the nucleus (on the scale of the figure above, the nucleus has to be drawn as 1 micro meter!) and last but not least: the nucleus as presented has to 'explode' due to the enormous repulsive force, compared to the gravitational force.

## 2 Solution of modern physics to prevent the ‘explosion’ of nuclei

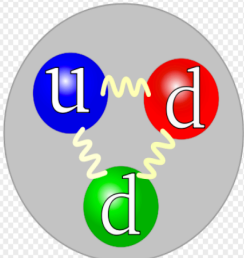
Reference [1] presents the following information:

	<p>“An atomic nucleus is shown here as a compact bundle of the two types of nucleons, protons (red) and neutrons (blue). In this picture, the protons and neutrons are shown as distinct, which is the conventional view in chemistry, for example. But in an actual nucleus, as understood by modern nuclear physics, the nucleons are partially delocalized and organize themselves according to the laws of quantum chromodynamics.”</p>
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Reference [2] explains what is meant with quarks in a proton

	<p>“Three colored balls (symbolizing quarks) connected pairwise by springs (symbolizing gluons), all inside a gray circle (symbolizing a proton). The colors of the balls are red, green, and blue, to parallel each quark's color charge. The red and blue balls are labeled ‘u’ (for ‘up’ quark) and the green one is labeled ‘d’ (for ‘down’ quark). A proton is composed of two up quarks, one down quark, and the gluons that mediate the forces ‘binding’ them together. The color assignment of individual quarks is arbitrary, but all three colors must be present. Electric charge <math>+2/3 e, -1/3 e</math>”</p> <p><i>Net electric charge: <math>2*2/3 e - 1/3 e = 1e</math>.</i></p>
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Reference [3] explains what is meant with quarks in a neutron

	<p>“The quark structure of the neutron. There are two down quark in and one up quark. The strong force is mediated by gluons (wavey). The strong force has three types of charges, the so called red, green and the blue. Note that the choice of blue for the up quark is arbitrary; the ‘color charge’ is thought of a circulating between the three quarks. Electric charge <math>0 e (-2\pm 8)\times 10^{-22} e</math> (experimental limits)”</p> <p><i>Net electric charge is <math>+2/3 e - 2*1/3 e = 0</math>.</i></p>
---	---

The mentioned net electric charge of the proton respectively neutron thus is still  $1e$  respectively  $0$ , so the problem under consideration is not yet solved, in fact magnified, because now the quarks, at an even shorter distance between themselves, have to be held together also.

If gluons would solve the last mentioned problem, the question arises why these magic particles are not applied directly, so without the quarks, in order to keep the protons and neutrons together.

In section 4, after having considered the electron-proton paradox in section 3, a philosophy is presented that might solve the problem with conventional physics.

### 3 Electron-Proton paradox

Before the announced alternative philosophy will be presented the radius of the electron, playing an essential role in this philosophy, has to be defined. Reference [4] gives the following background:

“The classical electron radius is a combination of fundamental physical quantities that define a length scale for problems involving electrons interacting with electromagnetic radiation. According to modern understanding, the electron is a point particle with a point charge and no spatial extent. Attempts to model the electron as a non-point particle are considered ill-conceived and counter-pedagogic. Nevertheless, it is useful to define a length that arises in electron interactions in atomic-scale problems. The classical electron radius is given as (in SI units)”

$$r_e = 1/4\pi\epsilon_0 \cdot e^2/m_e c^2 = 2.8 \cdot 10^{-15} \text{ m}$$

The decimal numbers have been restricted to one, because the order of magnitude turns out to be much more important than the accuracy of the value.

If this definition would be applied to a proton the result would be:

$$r_p = 1/4\pi\epsilon_0 \cdot e^2/m_p c^2 = 1.5 \cdot 10^{-18} \text{ m}$$

This value deviates enormously from the generally accepted radius of a proton ( $8.7 \cdot 10^{-16}$  m). This is the first reason to reject the definition of the radius of the electron.

The second, most fundamental, reason to reject the expression for  $r_e$  is the following. The equation  $F_C = \kappa e^2/r^2$  shows the repulsive force between two electrons at distance  $r$ , with

$\kappa$	Coulomb's constant	$(1/4\pi\epsilon_0)$	$9.0 \cdot 10^9$	$\text{Nm}^2\text{C}^{-2}$
$e$	electric charge of the electron		$1.6 \cdot 10^{-19}$	C

Multiplying both sides with  $r$  results in  $F_C \cdot r = \kappa e^2/r$ . The expression  $F_C \cdot r$  represents energy. Replacing this energy, for whatever reason, by the relativistic expression for energy:  $E = mc^2$ , results in the expression for  $r$  as shown above. Such kind of physics has to be considered as most reprehensible.

The third reason to reject the expression for  $r_e$  is that this radius of an electron is 3 times larger than the generally accepted value of the radius of a proton, while its mass is about 2000 times lower than the mass of a proton.

In this article it is *assumed* that the mass density of an electron and a proton is the same.

Given the mass of an electron resp. proton as  $9.1 \cdot 10^{-31}$  resp.  $1.7 \cdot 10^{-27}$  kg and given the radius of a proton as  $8.7 \cdot 10^{-16}$  m, the radius of an electron is calculated as  $7.1 \cdot 10^{-17}$  m

The consequence of this definition is that the electrical charge density of an electron, whether it is expressed in C/kg or in C/m<sup>3</sup>, is about 2000 times higher than the one of a proton.

This leaves us with the fundamental question: what is mass?

Especially regarding the fact that the *mass density* of both particles is incomparably high:  $6 \cdot 10^{17}$  kg/m<sup>3</sup>!

## 4 Philosophy about an alternative solution for the ‘explosive’ nucleus

The atomic model of Bohr in principle solves an equivalent but opposite problem as the one in the nucleus of the atom. In Bohr’s model electrons and protons are close together, but do not fuse, by letting the electrons to orbit the gathering of protons and neutrons in the nucleus. So the unavoidable solution seems to be that the protons in a nucleus have to orbit in order to eliminate their mutual repulse forces. Besides that:

Everything the Power of the World does is done in a circle.  
Black Elk, Holy Man of the Oglala Sioux 1863-1950

Therefore it is assumed that:

- *a neutron is a proton around which an electron orbits at very short distance, from now on called newtron*
- *a proton in the nucleus orbits a newtron at a much larger distance*

N.B.

In an atomic nucleus the number of newtrons is for any element greater or equal to the number of protons. So all protons can orbit a newtron.

The mass of a newtron is nowadays presented as the mass of a proton plus 2.5 times the mass of an electron. In this model it would simply be the sum of these masses.

The two protons will be distinguished symbolically by  $P_I$  respectively  $P_O$ .  $P_I$  is the proton **I**nside the newtron,  $P_O$  is the proton **O**utside the newtron. The electron will be named N-electron.

An important condition in this model is that the distance between the both protons is much larger than the distance between the N-electron and  $P_I$ , being the orbital radius.

Such a condition significantly decreases the repulse force between these two protons.

By modelling all the  $P_O$ 's, represented by the atomic number  $Z$ , as orbiting a newtron the repulsive forces in the nucleus will completely be eliminated, solving the problem of the ‘explosive’ nucleus.

Considering the N-electron as a kind of shield between both protons it is assumed that the distance between the N-electron and  $P_O$  determines the attractive force between these two particles. So if the radius of the orbit of the N-electron is represented by  $r_{Ne}$  and the one of  $P_O$  by  $r_{PO}$ , the meant distance is  $r_{PO} - r_{Ne}$ . As a result there are three centripetal forces acting on  $P_O$ :

- 1 the repulsive force from  $P_I$  ( $-\kappa q^2/r_{PO}^2$ ), from now on written as  $F_{POPI}$
- 2 the attractive force of the N-electron ( $+\kappa q^2/(r_{PO} - r_{Ne})^2$ ), from now on written as  $F_{PONe}$
- 3 the fully negligible gravitational force between both protons.

The net result of the two remaining forces:  $F_{PONe} - F_{POPI}$ , from now on written as  $F_{net}$ , has to keep  $P_O$  in its orbit, balanced by the centrifugal force  $m_P v_{PO}^2 / r_{PO}$  as the result of its orbiting velocity  $v_{PO}$ .

So:  $m_P v_{PO}^2 / r_{PO} = F_{net}$  by approximation

resulting in:  $v_{PO} = \sqrt{(F_{net} r_{PO} / m_P)}$ .

The condition  $r_{PO} \gg r_{Ne}$  can be translated to the condition  $v_{Ne} \gg v_{PO}$ , with  $v_{Ne}$  the orbital velocity of the N-electron.

Such a kind of shield of the N-electron around the proton  $P_I$  contributes to the reduction of the repulsive force between  $P_O$  and  $P_I$ .

## 5 Investigation of the feasibility of the alternative atomic nucleus model

### 5.1 Condition: $v_{Ne}$ much higher than $v_{PO}$

To investigate this condition all the variables mentioned in section 4 will be calculated. That means that the calculations start with a value of  $r_{Ne}$  in the range  $10^{-15}$  up to  $10^{-12}$  m.

Variable	description	mathematical expression	dimension
$r_{Ne}$	orbital radius N-electron	value to be selected	m
$F_{Ne}$	centripetal force N-electron	$\kappa q^2 / r_{Ne}^2$	N
$v_{Ne}$	orbital velocity N-electron	$\sqrt{F_{Ne} r_{Ne} / m_e}$ <sup>1)</sup>	m/s
$r_{PO}$	orbital radius $P_O$ , chosen as:	10,8,6,4 and 2 times $r_{Ne}$	m
$F_{POPI}$	repulsive force $P_O$ versus $P_I$	$\kappa q^2 / r_{PO}^2$	N
$F_{POe}$	attractive force $P_O$ versus N-e	$\kappa q^2 / (r_{PO} - r_{Ne})^2$	N
$F_{net}$	net force on $P_O$	$F_{POe} - F_{POPI}$	N
$v_{PO}$	orbital velocity $P_O$	$\sqrt{F_{net} r_{PO} / m_p}$ <sup>2)</sup>	m/s

with:

$\kappa$	Coulomb's constant	$9.0 \cdot 10^9$	$Nm^2C^{-2}$
$q$	electric charge of the electron	$1.6 \cdot 10^{-19}$	C
$m_e$	mass of the electron	$9.1 \cdot 10^{-31}$	kg
$m_p$	mass of proton	$1.7 \cdot 10^{-27}$	kg

1) Based on the law for a circular orbit: centrifugal force equals centripetal force.

$$m_e v_{Ne}^2 / r_{Ne} = \kappa q^2 / r_{Ne}^2 = F_{Ne}, \quad \text{so } v_{Ne} = \sqrt{F_{Ne} r_{Ne} / m_e}$$

2)  $m_p v_{PO}^2 / r_{PO} = F_{net} / r_{PO}^2$ , so  $v_{PO} = \sqrt{F_{net} r_{PO} / m_p}$  by approximation

Three situations will be investigated.

1: The minimum value of  $r_{Ne}$  is considered as at least the radius of a proton plus the radius of an electron, being at least  $8.7 \cdot 10^{-16} + 7.1 \cdot 10^{-17} \sim 10^{-15}$  m. See section 3 for the radius of the electron. Table I shows that the criterion  $v_{Ne} \gg v_{PO}$  has been fulfilled.

$r_{Ne}$	$F_{Ne}$	$v_{Ne}$	$r_{PO}$	$F_{POPI}$	$F_{PONe}$	$F_{net}$	$v_{PO}$	$v_{PO}/v_{Ne}$
1,0E-15	2,3E+02	5,0E+08	1,0E-14	2,3E+00	2,8E+00	5,4E-01	1,8E+06	0,004
1,0E-15	2,3E+02	5,0E+08	8,0E-15	3,6E+00	4,7E+00	1,1E+00	2,3E+06	0,005
1,0E-15	2,3E+02	5,0E+08	6,0E-15	6,4E+00	9,2E+00	2,8E+00	3,2E+06	0,006
1,0E-15	2,3E+02	5,0E+08	4,0E-15	1,4E+01	2,6E+01	1,1E+01	5,2E+06	0,010
1,0E-15	2,3E+02	5,0E+08	2,0E-15	5,8E+01	2,3E+02	1,7E+02	1,4E+07	0,029

Table I:  $r_{Ne}$  has the minimum possible value for any atomic number  $Z$

2: The maximum value of  $r_{PO}$  is restricted by the minimum orbit of the electron orbiting the nucleus of the atom. In the atom with  $Z = 1$  this radius is  $a_0 = 5 \cdot 10^{-11}$  m. In order to leave space for the orbiting proton a maximum value for  $r_{Ne}$  has been chosen as  $10^{-12}$  m. See Table II for the result.

$r_{Ne}$	$F_{Ne}$	$v_{Ne}$	$r_{PO}$	$F_{POPI}$	$F_{PONe}$	$F_{net}$	$v_{PO}$	$v_{PO}/v_{Ne}$
1,0E-12	2,3E-04	1,6E+07	1,0E-11	2,3E-06	2,8E-06	5,4E-07	5,7E+04	0,004
1,0E-12	2,3E-04	1,6E+07	8,0E-12	3,6E-06	4,7E-06	1,1E-06	7,3E+04	0,005
1,0E-12	2,3E-04	1,6E+07	6,0E-12	6,4E-06	9,2E-06	2,8E-06	1,0E+05	0,006
1,0E-12	2,3E-04	1,6E+07	4,0E-12	1,4E-05	2,6E-05	1,1E-05	1,6E+05	0,010
1,0E-12	2,3E-04	1,6E+07	2,0E-12	5,8E-05	2,3E-04	1,7E-04	4,5E+05	0,029

Table II:  $r_{Ne}$  has the maximum possible value for atomic number  $Z = 1$

3: The minimum distance of the orbiting electron to a nucleus is  $4.5 \cdot 10^{-13}$  m ( $a_0/Z$  for  $Z = 118$ ). The value for  $r_{Ne}$  roughly belonging to this outcome is  $10^{-14}$  m. Table III shows the result.

$r_{Ne}$	$F_{Ne}$	$v_{Ne}$	$r_{pO}$	$F_{pOPI}$	$F_{pONe}$	$F_{net}$	$v_{pO}$	$v_{pO}/v_{Ne}$
1,0E-14	2,3E+00	1,6E+08	1,0E-13	2,3E-02	2,8E-02	5,4E-03	5,7E+05	0,004
1,0E-14	2,3E+00	1,6E+08	8,0E-14	3,6E-02	4,7E-02	1,1E-02	7,3E+05	0,005
1,0E-14	2,3E+00	1,6E+08	6,0E-14	6,4E-02	9,2E-02	2,8E-02	1,0E+06	0,006
1,0E-14	2,3E+00	1,6E+08	4,0E-14	1,4E-01	2,6E-01	1,1E-01	1,6E+06	0,010
1,0E-14	2,3E+00	1,6E+08	2,0E-14	5,8E-01	2,3E+00	1,7E+00	4,5E+06	0,029

Table III :  $r_{Ne}$  has the maximum possible value for atomic number  $Z = 118$

In this atom the radius  $r_{Ne}$  can only vary between  $10^{-15}$  and  $10^{-14}$  m. Surprisingly  $v_{pO}/v_{Ne}$  is exactly the same in all 3 situations

## 5.2 Verification of the volumes needed to accommodate the alternative nuclei

The volume to accommodate the alternative nuclei is determined by the volume inside the sphere with radius  $a_0/Z$ , being:  $(4/3)\pi(a_0/Z)^3$  m<sup>3</sup>. In this volume at least  $Z$  newton-proton pairs have to fit. The volume of such a pair is much larger than the volume of a single newton, because  $r_{pO} \gg r_{Ne}$ . For that reason the total volume of all the single newtons can be neglected relative to the total volume of  $Z$  newton-proton pairs.

So the total volume of these  $Z$  pairs has to be smaller than  $(4/3)\pi(a_0/Z)^3$  m<sup>3</sup>. The volume of one newton-proton pair is  $(4/3)\pi r_{pO}^3$ . This volume has to be taken twice as large because adding volumes of spheres requires to take the volume of the cubic inside which this sphere just fits. A sphere with radius  $r/2$  just fits in a cubic of size  $r$ . The ratio of these two volumes is  $\sim 2$ .

So a volume of  $2Z \cdot (4/3)\pi r_{pO}^3$  has to fit in the volume  $(4/3)\pi(a_0/Z)^3$ . As a result  $r_{pO}$  can be expressed as function of  $Z$ :  $r_{pO} = (a_0/Z) \cdot (2Z)^{-1/3}$  m.

Such a  $r_{pO}$  varies from  $4 \cdot 10^{-11}$  m for  $Z=1$  to  $7.3 \cdot 10^{-14}$  m for  $Z = 118$ . Dividing these outcomes by 10 in order to compare them with possible radii  $r_{Ne}$  proves that for  $Z = 118$  this radius still is significant larger than the orbiting radius of the N-electron in the newton.

### Alternative configuration

It is, in principle, also possible that all newtons are grouped together. Around this group of newtons one can imagine a cloud of “free” protons configured like the electrons around the nucleus in Bohr’s atomic model. Given the results obtained in section 5.1 and given the fact that such a configuration is of much less importance than the one of the neutron the author has abstained from giving further attention to this part of the model of the atomic nucleus.

### Intermediate conclusions:

- 1 The proposed model of a newton (an (inner) proton around which an electron is orbiting at a very short distance, ranging from  $10^{-15}$  to  $10^{-12}$  m) need at this moment not yet to be rejected. Neither the model of the atomic nucleus: a newton-proton pair in which an (outer) proton orbits such a newton at significant larger distance than the distance between the electron and the (inner) proton of the newton.
- 2 For  $r_{Ne} = 10^{-14}$  m the magnetic field strength is  $\approx 10^{16}$  A/m. This field strength multiplied by  $\mu_0$  ( $4\pi \cdot 10^{-7}$  NA<sup>-2</sup>) results in a magnetic flux density of  $\approx 10^{10}$  N/A.m or V.s/m<sup>2</sup> or Tesla. A comparable situation is the strength of a magnetar (“a type of neutron star with an extremely powerful magnetic field):  $10^8 - 10^{11}$  Tesla”.



## 6 Philosophy about orbiting electrons and emitting EM pulses

Chapter VIII presents a model of a photon based on the idea that an electron orbiting a nucleus at an inner orbit and jumping to an outer orbit creates a photon. This model also shows that the energy of the photon is not directly generated by the loss of the kinetic energy of the electron, but by the loss of the magnetic energy created by the electron due to its orbit. So two types of energy are converted: the decrease of kinetic energy into the decrease of the magnetic energy and the last one converted into EM-radiation of the photon.

Remark:

The phenomenon potential energy does not play a role in an atomic orbiting system. The background for this conclusion is that the centripetal and centrifugal forces, applied to the orbiting electron, are fully and continuously in balance in such an orbit. The only phenomenon that contains real energy is the kinetic energy of the orbiting electrons and the magnetic energy.

The misconception regarding the potential energy in an atom causes an incorrect image of it.

The incorrect words below from [5] (**Orbital energy**) have been replaced by the correct ones.

“In atoms with a single electron ....., the energy of an orbital ..... is determined exclusively by n. The n=1 orbital has the ~~lowest~~ *highest* possible energy in the atom. Each successively higher value of n has a ~~higher~~ *lower* level of energy, but the difference decreases as n increases. For high n, the level of energy becomes so ~~high~~ *low* that the electron can easily escape from the atom.”

The  ${}^1_1\text{H}$  atom looks like the here proposed newton model: an electron orbiting a proton, but at a minimum radius of  $a_0 = 5.3 \cdot 10^{-11}$  m, based on the equation:  $a_0 = \hbar^2 / (4\pi^2 \kappa q^2 m_e)$ .

A photon emitted by such an atom generates an EM radiation as shown in table IV.

See chapter VIII for the theoretical backgrounds.

n	$r_{ne}$	$v_{ne}$	$E_{kin}$	$\Delta E_{kin}$	$f_{hf}$	$f_{direct}$
1	5,3E-11	2,2E+06	2,2E-18			
2	2,1E-10	1,1E+06	5,5E-19	1,64E-18	2,47E+15	2,47E+15
3	4,8E-10	7,3E+05	2,4E-19	1,94E-18	2,92E+15	2,92E+15
4	8,5E-10	5,5E+05	1,4E-19	2,04E-18	3,08E+15	3,08E+15
5	1,3E-09	4,4E+05	8,7E-20	2,09E-18	3,16E+15	3,16E+15

Table IV : Possible frequencies of an emitted photon by a  ${}^1_1\text{H}$  atom

$\hbar$	Planck constant : $6.6 \cdot 10^{-34}$ kg m <sup>2</sup> s <sup>-1</sup>
$r_{ne}$	possible radii of the orbits relative to the nucleus of the ${}^1_1\text{H}$
$v_{ne}$	orbital velocity of the (atomic) electron
$E_{kin}$	kinetic energy of the (atomic) electron
$\Delta E_{kin}$	decrease of $E_{kin}$ jumping from n=1 to n=i
$f_{hf}$	frequency of the photon calculated as $\Delta E_{kin} / \hbar$
$f_{direct}$	frequency of the photon calculated as $c \cdot R (1/n_i^2 - 1/n_{i+1}^2)$
R	Rydberg's constant $m q^4 / (8 \epsilon_0^2 \hbar^3 c)$

Several tables like Table IV can be generated by choosing several different atomic numbers Z. The related possible radii of orbiting electrons around the nucleus are given as  $r_{ne} = n^2 a_0 / Z$ . The idea behind this strictly quantitative presentation of the radii is based on the assumption, *for whatever reason*, that the angular momentum  $m v r_n$  of the electron is quantized, expressed as:  $m v r_n = n \hbar / 2\pi$ . The minimum value of n is 1, so the minimum angular momentum is assumed to be  $\hbar / 2\pi$ , also written as  $\hbar$ . But the remark: *for whatever reason*, remains.

It is in principle possible to copy the idea of the quantized radii to the newton model.

Doing so and striving for the same kind of equation for the emitted frequency for a photon [5]:

$\Delta E_{\text{kin}} = hf = b \cdot c \cdot Z^2 \cdot R(1/n_1^2 - 1/n_2^2)$ , the value for  $b$  has to be decreased, because it is the only parameter in  $a_0$  that can be changed. This can be done by dividing  $b$  by an arbitrary number.

In this way, the variables  $f_{\text{hf}}$  and  $f_{\text{direct}}$ , as shown in Table IV, turned out to stay equal to each other. The consequences thus are that such a decreased  $b$  is applied to the minimum orbit  $a_0$  via  $b^2$ , to the Rydberg constant via  $b^3$  and directly to  $E=hf$ .

Given the fact that the atomic orbits depend on  $Z$  by the relation  $r_{\text{ne}} = n^2 a_0 / Z$ , leaves us with the conclusion that the larger the number  $Z$  of newton-proton pairs is, the smaller the volume is in which such a nucleus has to be accommodated. That argues also for a smaller orbital radius in the newton the larger  $Z$  is. For that reason it has been decided to transform  $b$  into  $b/CZ$ ,  $C$  yet to be determined. The largest  $Z$  (118) applied leads to a minimum radius of  $a_0/C^2 Z^2$ . The real minimum radius is  $10^{-15}$  m, so  $C = (\sqrt{5.3 \cdot 10^{-11}} / 10^{-15}) / 118 = 2$ .

The value  $2Z$  is the atomic weight number of an element with atomic number  $Z$  and the same number of protons and newtons in its nucleus! For that reason  $2Z$  has been named  $W$ .

Striving for a complete resemblance with the situation of the emission of normal photons, the same kind of quantisation of the orbits of the N-electron has been assumed.

The radius of an electron orbiting the nucleus of an atom is expressed as  $r_{\text{ne}} = n^2 a_0 / Z$ .

Now that the orbit of the N-electron in the nucleus of an atom with atomic number  $Z$  will be expressed as  $r_{\text{Ne}} = N^2 a_0 / 4Z^2$ , the following information about  $N_{\text{max}}$  can be calculated.

As shown above,  $r_{\text{PO}} = (a_0/Z) \cdot (2Z)^{-1/3}$  m. Taking for the ease of the calculation  $r_{\text{Nmax}} = r_{\text{PO}}$ , leads to:  $N_{\text{max}}^2 = (a_0/Z) \cdot (2Z)^{-1/3} / (a_0/4Z^2) = 2^{5/3} Z^{2/3}$ , so  $N_{\text{max}} = 2^{2.5/3} Z^{1/3}$ .

For  $Z=1$ ,  $N_{\text{max}} = 1.8$ , rounded to 2      For  $Z=118$ ,  $N_{\text{max}} = 8.7$ , rounded to 8, because  $r_{\text{Nmax}}$  has to be smaller than  $r_{\text{PO}}$ .

This result strengthens the trust in the correctness of the newton model and of the related alternative model of the atomic nucleus, fully resembling Bohr's atomic configuration.

For that reason the investigation of the emitted EM-field in case a N-electron in a newton jumps to an outer orbit, or out of the newton, is continued.

The frequency of the emitted N-photon has been calculated, via  $r_{\text{Ne}} = N_e^2 a_0 / W^2$ , in two ways:

$$f_{\text{hWf}} = \Delta E_{\text{kin}} / h_W = \Delta E_{\text{kin}} \cdot W / b \quad \text{and} \quad f_{\text{direct}} = c \cdot R_W (1/n_i^2 - 1/n_{i+1}^2), \quad \text{with } R_W = R \cdot W^3$$

Two extreme examples have been chosen. For  $Z=1$  the outcome is indeed only one frequency:  $2 \cdot 10^{16}$  Hz.

For  $Z=118$  the outcome is indeed 8 possible frequencies in the range  $10^{20} - 4 \cdot 10^{22}$  Hz.

Such a result is still promising.

However the next section shows what is wrong with this 'surprising' model.

Just for information:

Mega	•	Giga	•	Tera	•	Peta	•	Exa	•	Zetta	•	Yotta	Hertz
$10^6$		$10^9$		$10^{12}$		$10^{15}$		$10^{18}$		$10^{21}$		$10^{24}$	

## 7 Comparison of theoretical energy densities with practical values

Reference [13] mentions:

*“The practical maximum yield-to-weight ratio for fusion weapons (thermonuclear weapons) has been estimated to 25 TJ/kg.”*

In order to compare such a number with the outcome of the alternatively modelled atomic nucleus the quantity energy density, in terms of Joule/kg, has to be calculated with this model.

To transform the energy of a N-photon in element  ${}^W_Z\text{E}$  to the energy density of that element, being the total energy per 1 kg of this element, the rounded Avogadro constant ( $6 \cdot 10^{23}$ ) will be used. This constant is defined as: W gram of element  ${}^W_Z\text{E}$  contains  $6 \cdot 10^{23}$  atoms of that element.

The background of this constant is in principle plain: the atomic mass unit is defined as  $(m_N + m_P + m_e)/2$  leading to  $m_P + m_e$  taking the neutron model. Element  ${}^W_Z\text{E}$  contains Z protons + electrons + N neutrons, so W protons + electrons. The atomic mass unit is thus defined as  $1.67 \cdot 10^{-27}$  kg, applying the neutron model.

So 1 atom  ${}^W_Z\text{E}$  has a mass of  $W \cdot 1.67 \cdot 10^{-27}$  kg. As a result 1 kg of  ${}^W_Z\text{E}$  contains  $1/(W \cdot 1.67 \cdot 10^{-27})$  atoms and W kg of  ${}^W_Z\text{E}$  contains  $6 \cdot 10^{26}$  atoms.

The energy density is defined as the energy per kg. One kg of element  ${}^W_Z\text{E}$  contains  $6 \cdot 10^{26}/W$  atoms, but has N neutrons, because  $W = Z + N$ . The conversion factor from the kinetic energy  $E_{\text{kin}}$  of 1 electron in TeraJoule to this energy density  $E_d$  thus is:  $(N/W) \cdot 6 \cdot 10^{14} \text{ kg}^{-1}$ , with  $N/W \sim 0,5$ .

One neutron-electron has a kinetic energy of  $E_{\text{kin}} = \frac{1}{2} m_e v_{N_e}^2$  Joule, with  $v_{N_e}^2 = \kappa q^2 / m_e r_{N_e}$ .

The maximum  $E_{\text{kin}}$  in the model under consideration depends on the element, because the radius of the orbit of the N-electron has been chosen as  $r_{N_e} = N^2 a_0 / 4Z^2$ . Table V shows three examples.

Experiments with hydrogen atomic bombs show that the energy density of this element belongs to the category Uranium. So the ‘surprising’ model as described above has to be rejected. But the other two elements show a perfect agreement with the above mentioned information:

*“The practical maximum yield-to-weight ratio for fusion weapons has been estimated to 25 TJ/kg.”*

element	r	v	$E_{\text{kin}}$	$E_d$ (TJ/kg)
H	1,3E-11	4,4E+06	8,7E-18	0,003
U	1,7E-15	3,9E+08	6,8E-14	20
Og	9,5E-16	5,2E+08	1,2E-13	36

Table V : Maximum nuclear energy densities for 3 elements

N.B. The maximum energy density of the neutron ( $N/W = 1$ ) is 70 TJ/kg.

The method of calculating the energy density has been checked by calculating this variable for the *chemical* reaction of hydrogen with oxygen to water. This reaction also produces a large amount of energy, given its application in rocket launchings. Table VI shows the kinetic energy of the orbiting electron in a  ${}^2_1\text{H}$  atom at several possible orbits.

$n_e$	$r_{n_e}$	$v_{n_e}$	$E_{\text{kin}}$	$E_d$ (MJ/kg)
1	5,3E-11	2,2E+06	2,2E-18	654
2	2,1E-10	1,1E+06	5,5E-19	164
3	4,8E-10	7,3E+05	2,4E-19	73
4	8,5E-10	5,5E+05	1,4E-19	41
5	1,3E-09	4,4E+05	8,7E-20	26

Table VI : possible energy densities in a Hydrogen atom

Reference [12] tells that the ‘heating value’ of hydrogen is 120 á 140 MJ/kg.

So the calculation of the energy densities of the alternative nuclear model is most likely correct.

## 8 Calculation of the frequency and pulse length of nuclear photons

### 8.1 Calculation of EM-field strengths and EM-power densities

The amplitude of the sinusoidal shaped magnetic field of the carrier of the N-photon will be represented by  $A_H$ , like  $A_E$  will be the amplitude of its sinusoidal electric field.

The relation between  $A_H$  and  $A_E$  is:

$$A_E = Z_v A_H \quad \text{V/m}$$

where  $Z_v$  is the so called characteristic impedance for vacuum.

$$Z_v = (\mu_0/\epsilon_0)^{1/2} = 377 \quad \Omega$$

Based on these two variables the power density of the EM-field is:

$$P_d = A_E/\sqrt{2} \cdot A_H/\sqrt{2} = Z_v A_H^2/2 \quad \text{VA/m}^2$$

It is assumed that this power density is valid in the surface  $\pi r^2$ , comprised by the orbit  $r$  of the electron from which it jumps. So the power  $P$  of the N-photon is:

$$P = (Z_v A_H^2/2) \cdot \pi r^2 \quad \text{W}$$

In order to be able to calculate the energy of such a photon, this power has to be multiplied with its length, expressed in seconds. This length will be represented by the name pulse length, abbreviated as plsl.

The energy of the photon can now mathematically be expressed by:

$$E = \text{plsl} \cdot (Z_v A_H^2/2) \cdot \pi r^2 \quad \text{Joule}$$

### 8.2 Calculation of the pulse length

In the next situation a jump of the electron from orbit  $n_i$  to  $n_j$  in the newtron will be considered. In such a situation holds:  $v^2 = q^2\kappa/mr$ . During the jump of the electron the

magnetic field jumps from:  $H_i = q^2(\kappa/m)^{1/2}/4\pi r_i^{2.5}$  to  $H_j = q^2(\kappa/m)^{1/2}/4\pi r_j^{2.5}$

the power density from:  $Z_v A_{Hi}^2/2$  to  $Z_v A_{Hj}^2/2$

and the power from:  $Z_v A_{Hi}^2/2 \cdot \pi r_i^2$  to  $Z_v A_{Hj}^2/2 \cdot \pi r_j^2$

As a result:

The  $\Delta$  power of the EM field is  $\Delta P = (Z_v q^4 \kappa / 32 \pi m) \cdot (r_i^{-3} - r_j^{-3})$

The  $\Delta$  energy of the photon is  $\Delta E = \text{plsl} \cdot \Delta P$

This  $\Delta$  energy is also the  $\Delta$  kinetic energy  $\Delta E = 1/2 q^2 \kappa \cdot (r_i^{-1} - r_j^{-1})$

As a result:  $\text{plsl} = 16 \pi m q^{-2} Z_v^{-1} \cdot (r_i^{-1} - r_j^{-1}) / (r_i^{-3} - r_j^{-3}) \text{ s}$

In case  $r_j \gg r_i$ :  $\text{plsl} = 16 \pi m q^{-2} Z_v^{-1} \cdot r_i^2$

### 8.3 Two methods of calculating the frequency

#### 8.3.1 Method 1

Chapter VIII shows that for arbitrary  $Z$  the ratio  $\text{plsl}/T$  can be expressed as  $8\pi m(hZ_v)^{-1}\kappa a_0$  for all situations in which an electron jumps from the *smallest possible* radius ( $a_0/Z$ ) far away from this orbit. Assuming that this property can be applied to the nuclear photon means that the emitted frequency will obey this law too, as long as the electron jumps from a certain orbit to an orbit far away from this one. The results for five, theoretically not impossible, orbiting radii are shown in Table VII.

$r_N$	$v_N$	E	plsl	f	E(keV)
2,0E-15	3,6E+08	5,8E-14	1,9E-23	2,3E+24	358
2,0E-14	1,1E+08	5,8E-15	1,9E-21	2,3E+22	36
2,0E-13	3,6E+07	5,8E-16	1,9E-19	2,3E+20	4
2,0E-12	1,1E+07	5,8E-17	1,9E-17	2,3E+18	0,4
2,0E-11	3,6E+06	5,8E-18	1,9E-15	2,3E+16	0,0

Table VII: Pulse lengths, frequencies and energies of emitted N-photons

The table shows that  $f$  looks like to be proportional to  $E^2$ . A mathematical investigation of the relation between  $E^2$  and  $f$  results in the following expressions.

Given:

$$f = 8\pi m(hZ_v)^{-1}\kappa a_0/\text{plsl}, \quad \text{plsl} = 16\pi m q^2 Z_v^{-1} \cdot r_i^2, \quad r_i^2 = \frac{1}{4} q^4 \kappa^2 / E^2 \quad \text{and} \quad a_0 = h^2 / 4\pi^2 \kappa q^2 m$$

the relation

$$E^2 = \eta f$$

is found, with:

$$\eta = 2\pi^2 m \kappa^2 q^4 / h = 1.45 \cdot 10^{-51} \quad \text{J}^2 \text{s}$$

Having found this mathematical expression, the relation  $f = 8\pi m(hZ_v)^{-1}\kappa a_0/\text{plsl}$  can now be used to express the pulse length of the photon as function of the frequency:

$$\text{plsl} = 2h/\pi Z_v q^2 \cdot f^{-1} = 43.6/f \quad \text{s}$$

The equation  $E^2 = \eta f$  has been checked by comparing mathematically  $E^2/\eta$  with  $E/h$ , using the expressions for  $a_0$  and  $\eta$  in universal constants. The original orbit has to be  $a_0$  in as well the atomic ( $Z=1$ ) as the nuclear configuration. The frequency  $f$  is then indeed  $\eta/h^2$  and  $E$  is  $\eta/h$  Joule.

#### 8.3.2 Method 2

Chapter VIII shows that the equation  $E = hf$  is based on the outcome of Rydberg's experiments:

$1/\lambda = R(1/n_i^2 - 1/n_f^2)$ , with  $\lambda$  the wavelength of the emitted EM-field and  $n_i$  the number of the respective orbits, related to their radii by  $r_i = n_i^2 a_0$ , for  $Z = 1$ . The assumption is now that the Rydberg expression is also valid for  $n_f \gg n_i$ , resulting in  $1/\lambda = R/n^2$ , with  $n^2 = r/a_0$  and  $r$  a radius in the range  $10^{-11}$  until  $10^{-15}$  m. As a result  $f = c \cdot R \cdot a_0 / r$ , with  $R = m q^4 / 8\epsilon_0^2 h^3 c$  and  $a_0 = h^2 / 4\pi^2 \kappa q^2 m$ .

The final outcome is:  $E = \frac{1}{2} q^2 \kappa / r$  and  $f = E/h = \frac{1}{2} q^2 \kappa / r h$ . The result in the mentioned range of  $r$  is that  $f = 1.7 \cdot 10^{16}$  until  $1.7 \cdot 10^{20}$  Hz, so a much lower *maximum* frequency than in case of method 1.

Reference [11] promulgates:

*"Frequencies observed in astronomy range from  $2.4 \cdot 10^{23}$  Hz (1 GeV gamma rays) down to the local plasma frequency of the ionized interstellar medium ( $\sim 1$  kHz)."*

For that reason method 2 has been rejected.

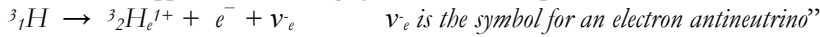
Table VII shows that the mentioned energy of 1 GeV, based on  $E = hf$ , is at least a factor 1000 higher than the maximum possible energy of the neutron/nuclear photon.

## 9 Contemplations about nuclear reactions

### 9.1 Tritium

Ref. [6] presents considerations about nuclear reactions related to Tritium and Lithium.

*“Tritium symbol  ${}^3_1\text{H}$ , also known as hydrogen-3, is a radioactive isotope of hydrogen. The nucleus of tritium (sometimes called a triton) has one proton and two neutrons. Tritium is used as a radioactive tracer, in radio luminescent light sources for watches and instruments, and, along with deuterium, as a fuel for nuclear fusion reactions with applications in energy generation and weapons.*



**Comment:**

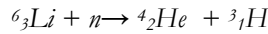
Based on the alternative nuclear model the expression:  ${}_x\text{E} = y.p + (x-y).(p+e) + ye = x.(p + e)$  shows that a neutral element  ${}_x\text{E}$  contains x protons and x electrons, independent of y.

The nuclear reaction thus shows, applying the alternative model, that a newtron emitted an electron out of the atom, creating a high frequency N-photon and leaving an  ${}^3_2\text{He}^{1+}$  ion.

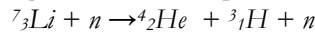
In modern physics an electron antineutrino is supposed to be created.

### 9.2 Lithium

*“Tritium is produced in nuclear reactors by neutron activation of lithium-6. “*



*“High-energy neutrons can also produce tritium from lithium-7...”*



**Comment:**

In both situations the total number of protons and electrons has not been changed after the reaction, applying the alternative model, neither a newtron was split into a proton and electron. Thus no radiation will be detected. Unless a N-electron jumps from an inner into an outer orbit in the same newtron during such a process.

### 9.3 Carbon-14 decay

Carbon-14 decays into Nitrogen-14, symbolically expressed as:  ${}^{14}_6\text{C} \rightarrow {}^{14}_7\text{N} + e^- + \nu_e$ .

In the alternative model a newtron in  ${}^{14}_6\text{C}$  emits an electron into the shell of the element under transition generating a N-photon and increasing the number of protons to 7. That changes  ${}^{14}_6\text{C}$  into  ${}^{14}_7\text{N}$ .

See 9.1 regarding the addition  $+ e^- + \nu_e$  in the reaction equation.

Quote from Wikipedia, regarding this nuclear reaction:

*“The emitted beta particles have a maximum energy of 156 keV, while their weighted mean energy is 49 keV.”*

Table VII shows that the mentioned energies belong to the possible energies of emitted N-photons in the newtron model. These energies are in modern physics used to calculate the mass of the alleged beta particles by means of  $E/c^2$ . The consequence of modern physics approach is that beta particles don't have a constant mass and are therefore undefined.

### 9.4 Alpha radiation

Reference [9] presents the following considerations.

*“Alpha decay or  $\alpha$ -decay is a type of radioactive decay in which an atomic nucleus emits an alpha particle (helium nucleus) and thereby transforms or 'decays' into an atom with a mass number that is reduced by four and an atomic number that is reduced by two. An alpha particle is identical to the nucleus of a helium-4 atom, ....”*

**Comment:**

The related symbolic equation is:  ${}^{238}_{92}\text{U} \rightarrow {}^{234}_{90}\text{Th} + {}^4_2\text{He}^2$

On the left and right hand side of the arrow the total number of protons and newtrons are the same, so no newtron has been split into a proton and an electron. On the left side are 92 electrons. On the right side 90 in Th, so there will be 2 in  ${}^4_2\text{He}^2$ , resulting in a normal He *atom*, not a He *nucleus*! That would mean that the alpha particle is a normal He atom.

*“Approximately 99% of the helium produced on Earth is the result of the alpha decay of underground deposits of minerals containing uranium or thorium.”*

**Comment:**

So indeed, no Helium ions/nuclei, but  ${}^4_2\text{He}$  atoms!

*“Alpha particles have a typical kinetic energy of 5 MeV (or  $\approx 0.13\%$  of their total energy, 110 TJ/kg) and have a speed of about 15,000,000 m/s, or 5% of the speed of light.”*

**Comment:**

A Helium atom/nucleus moving with the mentioned speed has indeed a kinetic energy of 5MeV!

The shown 110 TJ/kg is not energy, but energy density! The maximum possible energy density is the one of the newtron: 70 TJ/kg. See section 7, below Table V.

## 9.5 Beta-decays

Reference [10] shows examples of the so-called  $\beta$  decays, distinguished in  $\beta^-$  and  $\beta^+$  decays. The first mentioned one is also presented as electron emission, the second one as positron emission.

**“ $\beta^-$  decay (electron emission)**

*An unstable atomic nucleus with an excess of neutrons may undergo  $\beta^-$  decay, where a neutron is converted into a proton, an electron, and an electron antineutrino...:  $n \rightarrow p + e^- + \bar{\nu}_e$ ”*

**Comment:**

In the newtron model a  $\beta^-$  decay is simply the emission of an electron out of the atom, accompanied by the emission of an N-photon with a frequency  $f = E^2/\eta$  Hz.

In modern physics it is described as:

*“This process is mediated by the weak interaction. The neutron turns into a proton through the emission of a virtual  $W^-$  boson. At the quark level,  $W^-$  emission turns a down quark into an up quark, turning a neutron (one up quark and two down quarks) into a proton (two up quarks and one down quark). The virtual  $W^-$  boson then decays into an electron and an antineutrino.”*

Reference [10] also presents:

*“ $\beta^-$  decay commonly occurs among the neutron-rich fission by-products produced in nuclear reactors. Free neutrons also decay via this process. Both of these processes contribute to the copious quantities of beta rays and electron antineutrinos produced by fission-reactor fuel rods.”*

**Comment:**

See the last sentence under 9.3: “The consequence of the modern physics approach is that beta particles don’t have a constant mass and are therefore undefined.”

**“ $\beta^+$  decay and electron capture**

*The nuclear reaction  ${}^4_2\text{He} + {}^{27}_{13}\text{Al} \rightarrow {}^{30}_{15}\text{P} + {}^1_0\text{n}$  emits a positron, like observed in cosmic rays”*

**Comment:**

The symbol  ${}^1_0\text{n}$  suggest that this element has no protons neither electrons and 1 newtron. From the point of view of the alternative model, the symbol would be  ${}^1_1\text{n}$ , presenting that the element has one proton, one electron and no newtrons, exactly what this model says. The balance of protons and electrons, calculated by the expression:  ${}_x^y\text{E} = x.(p+e)$ , shows that  ${}^1_0\text{n}$  has to be a newtron as proposed in the alternative model. Modern physics presents  ${}^1_0\text{n}$  as a positron, written as  $e^+$  or  $\beta^+$ , according to [7].

Element  ${}^{30}_{15}\text{P}$  turns out to be an instable element, with a half-life time of 2.5 minutes changing into  ${}^{31}_{15}\text{P}$ , “in decay mode  $\beta^+$ “, according to [8]. In such a case the element  ${}^1_0\text{n}/{}^1_1\text{n}$  seemingly moved to the nucleus of the Phosphor isotope  ${}^{30}_{15}\text{P}$ . If emission of energy has been detected, then the newtron model would explain this by the emission of a N-photon, as a result of the jump of an electron, belonging to this newtron, from an inner to an outer orbit.

## 9.6 Gamma radiation

Reference [14] presents: “Gamma rays are emitted during nuclear fission in nuclear explosions.”

The accompanying figure shows that Gamma radiation is supposed to start somewhere between  $10^{19}$  and  $10^{20}$  Hz, not showing the end. Table VII shows a theoretical range of  $2 \cdot 10^{16} - 2 \cdot 10^{24}$  Hz for N-photons. Chapter VIII proves that theoretically a normal, so atomic, photon can have frequencies up to  $4 \cdot 10^{19}$  Hz. In the range  $2 \cdot 10^{16} - 4 \cdot 10^{19}$  Hz both types of radiations can be found. That may lead to confusion regarding what has to be understood with gamma radiation.

## 9.7 Geiger - Müller counter

The Geiger – Müller counter is, for example, explained in reference [15].

*“The Geiger–Müller (G–M) tube is the sensing element of the Geiger counter instrument used for the detection of ionizing radiation\*. .....*

*It is a gaseous ionization detector and uses the Townsend avalanche phenomenon to produce an easily detectable electronic pulse from as little as a single ionising event due to a radiation particle. It is used for the detection of gamma radiation, X-rays, and alpha and beta particles. It can also be adapted to detect neutrons. ....”*

\* Ionizing radiation is radiation with such a high energy that it is able to ionize an atom.

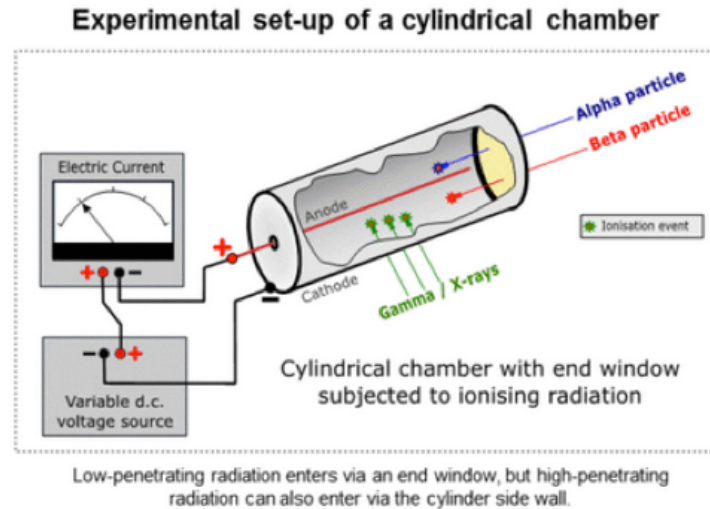


Figure 2: Geiger - Müller counter

### Comment:

As has been presented above, a nuclear fusion in most cases causes a nuclear photon, being an EM-wave during a certain very short period. The EM-energy of such a pulse defines its frequency by means of  $f = E^2 / \eta$ . So this energy doesn't have anything to do with kinetic energy.

Kinetic energy is generated where Helium atoms, neutrons, protons or electrons escape from the atomic nucleus. In all these situations the ionizing in the tube of the G-M counter can be activated.

So, whatever the frequency of an N-photon is, emitted by the alternatively modelled atomic nucleus, the G-M counter will detect such a radiation, assumed the energy of such an N-photon is high enough. Given the “specifications” of the G-M detector, most likely all N-photons do have enough energy, to activate it.

## 9.8 Last but not least contemplation: about the “Free neutron decay”

Reference [16] shows the following reaction equation:  $n^0 \rightarrow p^+ + e^- + \nu_e$ , explained in the first half of the 20th century using the ‘modern physics words’: (weak) boson, matching antineutrino, beta decay, charged weak current and a down quark converting into an up quark. Later on:  $n^0 \rightarrow p^+ + e^- + \nu_e + \gamma$ , with  $\gamma$  described as: “an emitted gamma ray, to be thought of as a sort of “internal bremsstrahlung” that arises as the emitted beta particle (electron) interacts with the charge of the proton in an electromagnetic way. In this process, some of the decay energy is carried away as photon energy.”

Under **Energy budget** the following text is found.

“For the free neutron, the decay energy for this process (based on the rest masses of the neutron, proton and electron) is 0.782343 MeV. That is the difference between the rest mass of the neutron and the sum of the rest masses of the products. That difference has to be carried away as kinetic energy. The maximal energy of the beta decay electron .....has been measured at **0.782±0.013 MeV.**”

**If in the neutron the electron is orbiting at a radius of  $8.9 \cdot 10^{-16}$  m, being  $0.2 \cdot 10^{-16}$  m outside the proton, its velocity will be  $5.3 \cdot 10^8$  m/s and its kinetic energy E is  $1.3 \cdot 10^{-13}$  J = **0.78 MeV !****

**When this electron escapes from the proton, a Nuclear-photon is generated with an expected frequency of  $1.2 \cdot 10^{25}$  Hz, based on  $f = E^2 / \eta$ , with  $\eta = 1.45 \cdot 10^{-51}$  J<sup>2</sup>s, reasoned in section 8.3.1.**

**The expected pulse length of such a photon is  $4 \cdot 10^{-24}$  seconds, reasoned in section 8.2.**



## 10 Nuclear fusion reactions in Sun's core

### 10.1 The modern physics approach

A piece of text copied from [17] sounds:

*“The proton–proton chain reaction, also commonly referred to as the p–p chain, is one of two known sets of nuclear fusion reactions by which stars convert hydrogen to helium.”*

The related nuclear reaction formulas are presented as follows:

*“The first step in all the branches is the fusion of two protons into deuterium. As the protons fuse, one of them undergoes beta plus decay, converting into a neutron by emitting a positron and an electron neutrino (though a small amount of deuterium is produced by the ‘pep’ reaction:  $p + p \rightarrow {}^2_1\text{D} + e^+ + \nu_e + 1.442 \text{ MeV}$ ”*

Comment:

Remark: The addition: “(though a small amount of deuterium is produced by the ‘pep’ reaction)” doesn’t make sense.

The rather unusual presentation  $p+p$  most likely originates from the assumption that Sun’s core is a plasma. Plasma is defined as 1 of the 4 fundamental states of matter in which (copied from [18]) “*electrons are ripped away from their nuclei, forming an electron “sea”*”.

So the plasma in Sun’s core is modelled as hydrogen ions ‘swimming in an electron sea’.

A typical modern physics model, not taking into account that such a gathering must lead to the elimination of both components, resulting in “pure mass”, whatever that may be.

The 2 protons on the left side have  $2e^+$  electric charge. On the right side the net electric charge of  ${}^2_1\text{D}+e^+$  is zero, because  ${}^2_1\text{D}$  suggests to have one electron in its shell. That makes the equation unreliable. But letting these protons “swim in an electron sea naturally” ‘solves’ that problem.

The description of the p–p chain continues with:

*“After it is formed the deuterium, produced in the first stage, can fuse with another proton to produce the light isotope of helium,  ${}^3_2\text{He}$ :  ${}^2_1\text{D} + {}^1_1\text{H} \rightarrow {}^3_2\text{He} + \gamma + 5.49 \text{ MeV}$ ”*

*“The overall reaction is:  $4{}^1\text{H}^+ \rightarrow {}^4\text{He}^{2+} + 2e^+ + 2\nu_e$  releasing 26.73 MeV of energy,....”*

Comment:

Remark:  ${}^1_1\text{H}$  is not (“another”) proton, but a protium atom, so with 1 electron in its shell. Anyway, the balance of electric charge is correct in the first equation: only neutral atoms.

In the following equation  ${}^1\text{H}^+$  is neither more nor less than a proton. It should have been written as  ${}^1_1\text{H}^+$ , or just p. The same applies to symbol  ${}^4\text{He}^{2+}$ , to present as  ${}^4_2\text{He}^{2+}$ , Together with  $2e^+$  the electric charge balance is correct. But a curious phenomenon has been presented: 4 protons, ‘swimming in an electron sea’, change into a Helium ion. Stated in another way: 4 protons change into 2 protons plus 2 neutrons, gathered as one nucleus. Why would 2 free ‘swimming’ protons come together (with 2 neutrons) given the repulsive force between the protons?

### 10.2 The alternative physics approach

In terms of the newtron, the equation  $4{}^1_1\text{H} \rightarrow {}^4_2\text{He}$  will be written as  $4{}^1_1\text{n} \rightarrow {}^4_2\text{He}$ , with  ${}^1_1\text{n}$  defined as element ‘n’ with 1 proton in its nucleus and 1 orbiting electron at a distance smaller than  $a_0$ . Such elements can freely move, just like atoms can, and represent an enormous amount of kinetic energy of the orbiting electron. So the temperature of such a gas is also extremely high, because higher orbital velocities cause higher velocities of the atoms, due to mutual collisions. And higher velocities of atoms represent higher temperatures.

In this nuclear fusion 4 elements ‘n’ are fused to 1 atom  ${}^4_2\text{He}$ . That means that 2 newtrons have been maintained and that the 2 electrons in the 2 other newtrons jumped to a shell of the Helium atom in statu nascendi. Such a fusion generates a lot of energy, certainly when expressed in energy density.

This energy is released as a here-called N-photon, in the range  $10^{20}$  to  $10^{25}$  Hz. The theoretically highest possible energy is 0.7 MeV per newtron.

So this nuclear fusion has to be written as  $4^1_1\text{n} \rightarrow ^4_2\text{He} + (1.4 \text{ MeV of } 2 \text{ N-photons})$ . The energy 0.7 MeV per newtron represents an energy density of  $1 \cdot 10^{-13} \text{ J} / 1.7 \cdot 10^{-27} \text{ kg}$ , presented as rounded value: 70 TJ/kg.

It will be investigated how this alternative approach fits with the parameters of Sun's core. It is hypothesized that this core consist of an ideal gas, built up by the elements  $^1_1\text{n}$ , written as 'n'.

The ideal gas law sounds:  $E = PV = CT$ , with  $C = nN_A k_B = Nk_B$  and:

E	energy of the gas		J
P	pressure of the gas		N/m <sup>2</sup>
V	volume of the gas		m <sup>3</sup>
n	amount of substance of gas in V		mol
N <sub>A</sub>	Avogadro's constant	$6 \cdot 10^{23}$	mol <sup>-1</sup>
N	total number of particles in V	$nN_A$	
k <sub>B</sub>	Boltzmann constant	$1.38 \cdot 10^{-23}$	J/K

The parameters of Sun's core are:  $T = 15 \cdot 10^6 \text{ K}$ ,  $P = 26.5 \text{ PPa} = 26.5 \cdot 10^{15} \text{ N/m}^2$  The density is, copied from [19]:  $150 \text{ g/cm}^3 = 150 \text{ kg/dm}^3 = 1.5 \cdot 10^5 \text{ kg/m}^3$ . One cubic meter of such an ideal gas thus contains  $26.5 \cdot 10^{15} \text{ Joule}$ . Given the ideal gas law:  $Nk_B T = 26.5 \cdot 10^{15} \text{ Joule}$ , so  $N = 1.3 \cdot 10^{32}$ .

Another way to calculate N is applying the density:  $N = 1.5 \cdot 10^5 / 1.7 \cdot 10^{-27} = 0.9 \cdot 10^{32}$ .

The mass of the newtron is the sum of the mass of a proton and an electron. The last one is negligible w.r.t. the first one, so  $m = 1.7 \cdot 10^{-27} \text{ kg}$ .

Given the small difference between the two outcomes of N the rounded mean value is taken:  $N = 10^{32}$ .

With this information it can be checked whether the condition of an ideal gas is met:

*The average distance between the elements is much larger than their size.*

The smallest possible radius of 'n' is  $10^{-15} \text{ m}$ , so the total volume of the elements is  $10^{32} \cdot 4 \cdot 10^{-45} = 4 \cdot 10^{-13} \text{ m}^3$ . This volume is much smaller than  $1 \text{ m}^3$ , so the condition is met easily.

An interesting calculation is what the radius of the orbiting electron in 'n' is allowed to be in order to fulfil this condition. The chosen criteria is a maximum volume of  $0.1 \text{ m}^3$ . To compensate for the space between the spherical shaped elements, the volume of 'n' has to be multiplied by 2, so  $2 \cdot 10^{32} \cdot (4/3) \pi r_{\text{max}}^3 = 0.1 \text{ m}^3$ . The outcome is  $r_{\text{max}} = 5 \cdot 10^{-12} \text{ m}$ , being 10 times smaller than  $a_0$ .

### **Conclusion: the newtron fits well with the published parameters of the Sun's core**

Given this conclusion, what to do with the state 'plasma' of matter? Accepting the alternative approach, the model of protons 'swimming in the electron sea' has to be rejected and replaced by a gas constituted by newtrons, at least regarding the plasma in Sun's core.

For the ease of the consideration only newtrons have been taken as elements of the gas, but given the space they have, other elements like  $^4_2\text{He}$  are admitted too, as long as the majority consists of newtrons.

# 11 Nuclear photon instead of elementary particle

The detection of elementary particles is carried out by means of energy detection. The transformation to mass is based on the expression  $E = mc^2$ . This expression has also been used to define a new kind of mass unit:  $eV/c^2$ . The philosophy is as follows.

Multiplying one kg mass with  $c^2$  results in an energy of  $9 \cdot 10^{16}$  Joule. One Joule equals  $6 \cdot 10^{18}$  eV. So  $9 \cdot 10^{16}$  Joule =  $54 \cdot 10^{34}$  eV. This applied in  $E = mc^2$  gives:  $5.4 \cdot 10^{35}$  eV =  $1 \text{ kg} \cdot c^2$ , leading to:

$$1 \text{ kg} = 5.4 \cdot 10^{35} \text{ eV}/c^2 \text{ and to } 1 \text{ MeV}/c^2 = 1.85 \cdot 10^{-30} \text{ kg}$$

The result is shown in the figure below, copied from reference [20].

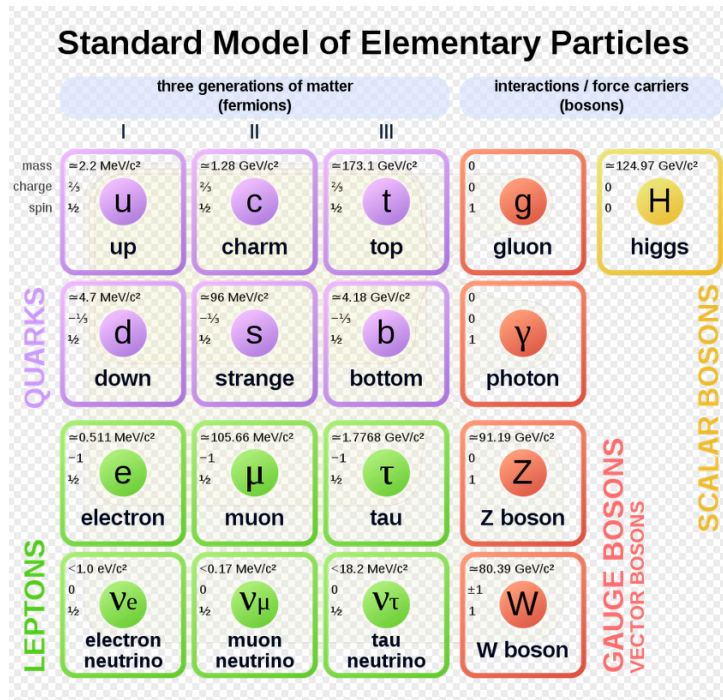


Table VIII below shows some examples from this figure. In this table the column “Joule” shows  $\text{kg} \cdot c^2$ . The highest possible energy is the one of the newtron with an electron orbiting at a distance just larger than the radius of the proton, say  $10^{-15}$  m. This energy is  $1.2 \cdot 10^{-13}$  Joule. That shows that the energies related to the particles muon until Higgs in Table VIII are extremely unlikely. The maximum energy density of the newtron is  $1.2 \cdot 10^{-13} \text{ J} / 1.7 \cdot 10^{-27} \text{ kg} = 71 \text{ TJ/kg}$ . The outcome of the modern physics approach is that all elementary particles have the same energy density: 90 PetaJoule/kg! Expressed in J/kg the numerical outcome is  $E/m = c^2$ !

Particle	MeV/c <sup>2</sup>	kg	Joule	PJ/kg	v/c
electron	0,5	9,3E-31	8,3E-14	90	1,41
up	2,2	4,1E-30	3,7E-13	90	1,41
muon	106	2,0E-28	1,8E-11	90	1,41
charm	1280	2,4E-27	2,1E-10	90	1,41
Z-boson	91190	1,7E-25	1,5E-08	90	1,41
Higgs	125000	2,3E-25	2,1E-08	90	1,41

Table VIII: Some examples of detected elementary particles

Speaking about the energy of a particle with a certain mass is only possible if it has a kinetic energy, relative to the detector. This in opposite to the newtron that does have an internal energy. Given the 4 unlikely high Joule values in Table VIII, the question arises how these kinetic energies have been detected. The fact that only the kinetic energy of the particles can have been measured, leads to the conclusion that their velocity must be  $\sqrt{(2 \cdot \text{Joule}) / \text{kg}}$  in Table VIII. The outcome may not be surprisingly:  $v = c \cdot \sqrt{2}$ . Another evidence of the unsustainability of the theories of relativity.

## Conclusions

The proposed model of a neutron, as an electron orbiting a proton at extremely short distance, here called newtron, leads to the following conclusions:

1. The repulsive forces between protons in nuclei are 'eliminated' by assuming that these protons on their turn orbit such newtrons.
2. The exotic particles quarks and gluons, held together by magic forces, have become unnecessary in the alternative model.
3. The newtrons can emit photons, called nuclear-photon, like atoms do when orbiting electrons around the nuclei jump from an inner to an outer orbit. Their frequencies are found in the range  $2.10^{16} - 2.10^{24}$  Hz.
4. In case the electron jumps far away from its orbit the emitted frequency of the nuclear-photon obeys the law  $E^2 = \eta f$ , with  $\eta = 2\pi^2 m \kappa^2 q^4 / h = 1.45 \cdot 10^{-51} \text{ J}^2 \text{ s}$ ,  $m$  the mass of the electron,  $q$  its electric charge, and  $\kappa$  and  $h$  Coulomb's resp. Planck's constant.
5. In contrast to the large number of different types of particles, which are claimed to be detected in several experiments, the alternative model claims that the energy of these alleged particles has to be interpreted as the EM-energy of nuclear-photons.
6. A closer look at the detection of particles learns that they all have the same energy density  $c^2 \text{ J/kg}$  as a result of the application of  $E = mc^2$ . That doesn't look reliable.
7. Alpha particles, to be read as normal He atoms/ions, newtrons and electrons are indeed particles that can be emitted during certain nuclear reactions.
8. The alternative model shows that nuclear reactions can create energy densities in accordance with publicly presented values: several tens of TJ/kg.
9. The newtron fits with three published parameters of the Sun's core.
10. The radius of an electron, based on  $\kappa e^2 / m_e c^2$ , causes a significant contradiction with the generally accepted radius of a proton, applying this expression to a proton.
11. The here presented alternative model of the atomic nucleus claims that:
  - the atomic mass unit equals the mass of a proton plus electron, so of a newtron,
  - the atomic weight number is an integer,
  - the only elementary particles in universe are the proton and the electron.

## References

- [1] [https://en.wikipedia.org/wiki/Nucleon#/media/File:Nucleus\\_drawing.svg](https://en.wikipedia.org/wiki/Nucleon#/media/File:Nucleus_drawing.svg)
- [2] <https://en.wikipedia.org/wiki/Quark>
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## **XXIV Is the Earth an inertial system?**

*Summary - The earth rotates almost exactly along a circle around the sun, notwithstanding the fact that the sun lies significantly outside the centre of this circle. Assuming a perfect circle, the question is whether the earth in such a situation is an inertial system or not.*

### **1 Introduction**

The question can also be found on the internet [1], but the rotation of the earth around its north-south polar axis is included in the considerations, leading to confusion. This rotation is not considered in this chapter.

### **2 Definition of an inertial system**

An inertial system is a system that does not decelerate, neither accelerate in whatever direction. As a result its velocity is constant. No forces are exerted on the system.

### **3 Properties of a circular orbiting system**

The tangential velocity of such a system is constant, notwithstanding the fact that its components in the plane of the orbit are not constant. The forces that are exerted on the system (centripetal and centrifugal force) eliminate each other perfectly. So eventually, no forces are exerted on the system.

### **4 Answer to the question**

A circular orbiting system is an inertial system, because net there is no force exerted on the system.

### **Conclusion**

No experiment, not making use of external references, can be carried out on earth that will measure its orbital velocity.

The so-called Foucault pendulum demonstrates earth's rotation around its north-south polar axis.

[1] <https://www.quora.com/Is-the-earth-as-a-whole-considered-to-be-an-inertial-or-non-inertial-frame-of-reference>

## XXV Velocity of an electric current

*Summary - This chapter argues that the velocity of an electric current in a solid conductive wire most likely equals the orbital velocity of the valence electron(s) in the atom of the matter of the wire.*

### 1 Introduction

This chapter considers two approaches to calculate the velocity of an electric current: one based on the current itself as starting point, the other one based on the source of the current as starting point. Only currents in a solid conductive (copper) wire are considered, so excluding the propagation velocity of EM-waves, of which their velocity in a medium, not moving relative to the source of the EM-wave, can simply be expressed by the equation:  $v_p = 1/\sqrt{\epsilon\mu}$ , with  $\epsilon$  the dielectric permittivity and  $\mu$  the magnetic permeability of the medium under consideration.

In vacuum leading to:  $c = 1/\sqrt{\epsilon_0\mu_0}$ , relative to its source in the absence of another possible relevant reference.

### 2 The current as starting point

From the point of view of the phenomenon “electrical charge”  $Q$ , an electric current  $I$  is represented as  $Q/t$ , with  $t$  the time during which a charge  $Q$  passes a certain area where the current flows.

This principle has been applied developing a model of the generation of a photon. See chapter VIII. Copied from this chapter:

*“The fundamental part of the investigated model is the assumption that the orbit of an electron around the nucleus of an atom is equivalent to a circular shaped electric current, creating a magnetic field.*

Suppose the “round trip” of an electron is  $t$  seconds and its electric charge is represented by the symbol  $q$ . Then the first approximation of the meant electric current is  $q/t = i$  .”

At the end of the day it turned out that the words “the first approximation of” are superfluous.

However, in the situation under consideration (an electric current through a solid wire) the starting point is the current instead of a (moving) charge. From this point of view  $Q$  will be calculated as  $Q = n_e q S$ , with:

$Q$	electric charge per meter wire	C/m
$n_e$	density of the valence electrons of copper	$m^{-3}$
$q$	electric charge of an electron	C
$S$	surface of the cross section of the wire	$m^2$

The purpose of the addition “per meter wire” in the definition of  $Q$  is to be able to introduce a velocity of the current in terms of  $m/s$ .

Taking  $v_I$  as symbol for this velocity we can now write:  $I = Q \cdot v_I = n_e q S \cdot v_I$ .

The question: why would an arbitrary length and arbitrary cross section of a wire be representative for the velocity of the electric current in that wire, arises. Anyway, the calculation process will be continued.

So:  $v_I = I_d/n_e q$   $m/s$ , with  $I_d = I/S$ , being the surface density  $A/m^2$  of the current in the wire.

The calculation below shows that  $n_e = 8.5 \cdot 10^{28} m^{-3}$  (a copper atom has 1 valence electron)

N.B. The accuracy of the values doesn't play any role in this consideration.

Specific weight of copper:	$9 \cdot 10^3$	$kg/m^3$
Atomic weight of copper:	$1 \cdot 10^{-25}$	kg
Number of copper atoms	$9 \cdot 10^{28}$	$m^{-3}$

The charge of an electron equals  $1.6 \cdot 10^{-19}$  C, so  $v_I = I_d / n_e q = I_d \cdot 7 \cdot 10^{-11}$  m/s.

A normal current density is between 1 and 10 A/mm<sup>2</sup>, with the highest one representing the so-called "house-hold-configuration". This value expressed as  $10^7$  A/m<sup>2</sup> leads to  $v_I = 7 \cdot 10^{-4}$  m/s.

The consequence of this outcome is that if we switch on a light in a normal room it would take 7 meter /  $7 \cdot 10^{-4}$  m/s =  $10^4$  s  $\approx$  2.5 hours before we would see the light!

We clearly have to look for a completely other approach, also looking back to the question asked above: why would an arbitrary length and arbitrary cross section of a wire be representative for the velocity of the electric current in that wire?

### 3 The source as starting point

It is generally accepted that the source of an electric current can be a generator or a battery.

Copied from [1]:

"Electromotive force, abbreviated emf ..... is the electrical intensity or "pressure" developed by a source of electrical energy such as a battery or generator. A device that converts other forms of energy into electrical energy (a "transducer") provides an emf at its output. "

"In the case of a two-terminal device (such as an electrochemical cell) which is modeled as a Thévenin's equivalent circuit, the equivalent emf can be measured as the open-circuit potential difference or "voltage" between the two terminals. This potential difference can drive an electric current, if an external circuit is attached to the terminals."

But it can be, for example, also a charged capacitor.

Such an example shows that the source of an electric current in principle is an amount of electrical charge (on an object with respect to another object).

Such a charge will, getting the opportunity, flow from the one to the other object in order to create a balance between the charges on both sides. A wire, for example, can create such an opportunity.

It is generally accepted (there will always be exceptions) that electrons build up an amount of electric charge and that an electric field exists between opposite electric charged objects.

At the moment a wire is connected between such a pair of electric opposite charged objects, the mentioned electric field causes electrons at the one charged object to move to the other object through the wire in one way or another. The wire consists of so called valence electrons. The very first electron that leaves the wire to move to the positive charged object is replaced by a valence electron from an atom more close to the negative charged object. Both electrons can have only a velocity equal to their orbital velocity, because they just jump out of their orbit. This happens through the whole wire successively until an electron from the negative charged object replaces a valence electron most close to this object.

As a result the velocity of an electric current equals roughly the mentioned orbital velocity.

The calculation of this velocity is as follows.

Based on Bohr's atomic model the radii of the discrete orbits of the electrons are mathematically represented by  $r_n = n^2 a_0 / Z$ , with n is an integer, representing the n<sup>th</sup> orbit.

The radius  $a_0$  is the so-called Bohr radius, the smallest (n=1) in the atom under consideration.

The atom is characterized by its atomic number Z. Z=29 for copper.

$a_0$  is a constant, independent of whatever atom, expressed by:  $b^2 / (4\pi^2 \kappa q^2 m)$ , with:

$b$	Planck's constant	$6.6 \cdot 10^{-34}$	VAs <sup>2</sup>
$\kappa$	Coulomb's constant $(1/4\pi\epsilon_0)$	$9 \cdot 10^9$	Nm <sup>2</sup> C <sup>-2</sup>
$q$	electric charge of the electron	$1.6 \cdot 10^{-19}$	C
$m$	mass of the electron	$9 \cdot 10^{-31}$	kg

Given these values  $a_0 = 5 \cdot 10^{-11}$  m.

The 4<sup>th</sup> orbit of the copper atom is the orbit of its valence electron, so its radius is:  
 $r_4 = 42 \cdot 5 \cdot 10^{-11} / 29 = 3 \cdot 10^{-11}$  m. This result is necessary to calculate the orbital velocity.

The electron is held in its orbit by the centripetal and centrifugal forces applied to it. The centripetal one is the Coulomb force between nucleus and electron. The gravitational force between electron and nucleus is negligible small compared to the Coulomb force.

The centrifugal force equals  $mv^2/r$ , with  $v$  the orbital velocity of the electron.

So  $mv^2/r = \kappa Zq^2/r^2$ , resulting in  $v = (\kappa Zq^2/mr)^{1/2}$ . Applying  $r=r_4$  results in  $v = 2 \cdot 10^7$  m/s.

Fundamentally speaking the orbital velocity of the valence electrons must increase in order to be able to escape from its orbit, causing a higher velocity than just calculated.

This higher velocity causes the atoms to vibrate more violently, which leads us to the topic in the next section.

#### **4 Heating of the wire explained at atomic level**

An electric current through a wire generates heat in that wire. The generally accepted conception of heat is that the warmer the matter is, the more the atoms of the matter move/vibrate. In case of a gas and liquid the word 'move' is more applicable, while 'vibration' is used in case of solid matter.

The experience is that the higher the current in a certain wire the warmer it becomes. A high current means a lot of (valence) electrons per unit of time moving from one pole to the other.

It has to be assumed that whatever small the current is there will occur an arbitrary small heating of the wire. Which phenomenon does cause this heating? In this situation only one possibility is left, announced already at the end of section 3: the jump of the valence electron from the one to the other atom causes the atom to vibrate more violent.

Based on the theory presented in section 3, it has to be concluded that the velocity of the current, i.e. of the valence electrons, is independent of the strength of the current. A higher current therefore does not cause a higher temperature by atoms that vibrate more violently, but by more atoms that also vibrate to that same extent. This conclusion is supported by the fact that the higher the current the more electrons per time unit pass the wire, so the more atoms start to vibrate.

The next chapter tells more about the basic phenomenon of the heating at atomic level.

#### **Conclusion**

The velocity of an electric current is more or less equal to the orbital velocity of the valence electrons in the applied material, resulting in velocities of the order of 0.1 á 0.01 times the propagation velocity of light.

#### **Reference**

[1] [https://en.wikipedia.org/wiki/Electromotive\\_force](https://en.wikipedia.org/wiki/Electromotive_force)



## XXVI How electromagnetic radiation raises temperature

*Summary - This theoretical investigation started at the moment the author picked up a hot piece of metal that had lain in the sun during a few hours, by asking himself the question: how can electromagnetic radiation, considered at atomic level, cause raising the temperature of matter? The answer to that question has been found. However another question popped up (again): why are the orbits of electrons in an atom quantified? Only exactly orbiting at radii proportional to the square of integers is suspicious unnatural. Indeed, unless we define such a behaviour as natural, like in modern physics.*

### 1 Introduction

The relation between pressure, volume and temperature of an ideal gas is  $PV=CT$ . Based on this relation the pressure and temperature of one atom can be calculated, leading to interesting physical considerations at atomic level regarding the conversion of radiation to heat energy.

It turned out that asking the question, formulated in the summary, in case of a gas held together in a constant volume, leads to a beginning of understanding the phenomenon.

### 2 The ideal gas law

The relation  $PV=CT$ , well known as the ideal gas law, expresses the energy of such a gas, held together in the volume  $V$  under pressure  $P$  and absolute temperature  $T$ .

The constant  $C$  equals  $nN_Ak_B$ , with:

$n$	amount of substance of gas		mol
$N_A$	Avogadro's constant	$6.0 \cdot 10^{23}$	mol <sup>-1</sup>
$k_B$	Boltzmann constant	$1.38 \cdot 10^{-23}$	JK <sup>-1</sup>

The so-called gas constant  $R$  is defined as  $N_Ak_B = 8.3 \text{ JK}^{-1}\text{mol}^{-1}$ .

So, the ideal gas law expresses the energy of gas, in the volume  $V$ , in two ways:  $E=PV$  and  $E=nRT$ .

Starting with the arbitrary volume of  $1 \text{ m}^3$  and the arbitrary pressure of  $1 \text{ bar}$ , being  $10^5 \text{ N/m}^2$ , the energy of that gas is  $10^5 \text{ Joule}$ . For  $T=300 \text{ Kelvin}$ ,  $n=40 \text{ mol}$ .

The amount  $n$  of substance of gas, expressed in mol, equals  $N/N_A$ , with  $N$  the total amount of atoms. In the chosen example  $N=2.4 \cdot 10^{25}$ .

Taking  $N=1$  and  $P$  and  $T$  the same as in the example,  $n=1.7 \cdot 10^{-24} \text{ mol}$  and  $V=4 \cdot 10^{-26} \text{ m}^3$ .

This has to be compared to the volume of the atom, because one of the conditions of ideal gas is: "The average distance between molecules is much larger than the size of the molecules."

So in case of one atom the volume  $V$  has to be much larger than the volume of one atom.

Chapter VIII shows what the minimum volume of an H-atom is:  $(4/3)\pi a_0^3$ , with  $a_0$  the so-called Bohr radius ( $5.3 \cdot 10^{-11}$ ). Higher atom numbers  $Z$  have proportional smaller radii ( $a_0/Z$ ).

The related volume of an H-atom is  $6.2 \cdot 10^{-31} \text{ m}^3$ , being 66000 times less than  $V$ .

Intermediate conclusion:

An atom enclosed in a volume of  $4 \cdot 10^{-26} \text{ m}^3$  causes a pressure of  $1 \text{ bar}$  at a temperature of  $300 \text{ K}$ .

The atom itself does not have a temperature, because the space between nucleus and orbiting electrons is vacuum. It is the surroundings of this volume that determines the temperature.

And this temperature determines the pressure inside the volume.

### 3 Theory behind the phenomenon ‘temperature’

The generally accepted theory behind the phenomenon ‘temperature’ is that atoms make random movements and random elastic collisions with each other and with the boundary of the volume that holds them together. The higher the mean velocity of the atoms the higher the pressure of the gas, but, as has been concluded in section 2, the temperature of the gas will not increase if the temperature of the surroundings does not “allow” it to do so.

As a result the phenomenon: a piece of metal that had lain in the sun during a few hours and got hot, has to be interpreted as: ..... and got warmer, just like its surroundings got warmer.

At this point the ideal gas situation will be left in order to concentrate on the question how EM radiation can cause atoms to move faster or vibrate more violently, in whatever circumstances?

There is no possibility that EM radiation *directly* influences the velocity of the atoms. The only possibility is that EM radiation increases the orbital velocity of the electron orbiting the nucleus of the atom: opposite of the fact that EM radiation is created, by means of a photon, when such an electron is forced by external influences to jump from an inner to an outer orbit. See [1].

This reference also shows that the smaller the radius of such an orbit is the higher the orbital velocity has to be, in order to fulfil the requirement that centripetal and centrifugal force, applied to the electron, are in balance. Chapter VII shows that this higher orbital velocity represents a higher energy state of the atom, in contradiction with the generally accepted opinion that the atomic energy decreases with smaller orbit radii. That reference also shows why this opinion is fundamentally wrong.

Suppose, for the moment being, that the external EM radiation indeed causes orbiting electrons to jump to a lower orbit, thus to a higher orbital velocity. Then first of all the question: how can this higher orbital velocity cause a higher velocity of the atom, has to be answered.

To explain what might happen, a comparison with the behaviour of a spinning billiard ball on a billiard table, colliding the inner edge of this table, might help. In such a situation the ball reflects with more energy in its forward direction than it would do without spinning. On the opposite: if in the same situation the spinning of the ball is reversed, the reflection will cause a loss of kinetic energy in its forward direction. In both cases the spinning energy of the ball will decrease.

The same happens in case the reflection is w.r.t. another ball, in stead of the edge of the table.

An atom with its orbiting electrons looks, physically seen, like a spinning billiard ball.

Assuming the same kind of conversion of energy during a collision, atoms with faster orbiting electrons will thus on the average develop higher velocities. It has to be concluded too that mutual interactions will also lead to atoms with lower velocity, because electrons can also jump to higher orbits during a collision.

Such a model has at least to fulfil the criterion that the velocity of the atom has to be much smaller than the orbital velocity of its electron.

The kinetic energy  $\frac{1}{2}mv^2$  of one, for example, H-atom, with  $m$  the mass of the atom and  $v$  its velocity, must be equal to  $PV$ . With  $V = 4 \cdot 10^{-26} \text{ m}^3$  and  $P = 10^5 \text{ N/m}^2$ ,  $PV = 4 \cdot 10^{-21} \text{ J}$ .

The intrinsic energy of the atom, due to its orbiting electron, must not be added to this kinetic energy.

The mass of an  $^1\text{H}$ -atom is the sum of the mass of a proton and an electron. The last one is negligible w.r.t. the first one, so  $m = 1.7 \cdot 10^{-27} \text{ kg}$  and  $v = 2200 \text{ m/s}$ . The orbital velocity of the electron at radius  $a_0$  is  $2.2 \cdot 10^6 \text{ m/s}$ ! Such a kind of difference is also found in case of a  $^2\text{H}$ -atom.

It is therefore assumed that this model satisfactorily explains the increasing velocity/vibration of atoms, when orbital velocities of the electrons increase, *still assuming that the external EM radiation causes orbiting electrons to jump to a lower orbit with a higher orbital velocity.*

## 4 From EM radiation to orbital velocity

In section 3 it has been mentioned that a photon is generated in an atom when external forces compel an orbiting electron to jump from an inner to an outer orbit. Chapter VIII describes this in detail and also shows that actually not the kinetic but the magnetic energy of the atom is converted into the energy of the emitted photon. The orbiting electron creates this magnetic energy, due to the fact that such an electron represents a circular shaped electric current.

So such a model describes the phenomenon: from orbital velocity to EM radiation, leaving yet unanswered the question what kind of external force compels the electron to jump from an inner to an outer orbit and thus how this in more detail happens.

Remark:

Based on the spinning billiard ball model, it is likely that a neighbour atom can, during collision, function as an external force too. Not only to compel an electron from an inner to an outer orbit, but also contrary wise.

The situation to be investigated here is EM radiation as external force.

A curious phenomenon, from this point of view, is that a perfect black object will be heated by means of external EM radiation, of whatever frequency, received by this object.

A perfect white object, on the opposite, will not be heated at all by EM radiation. In fact a perfect white object does not receive external EM radiation. It just reflects it!

The phenomenon resembles rather much EM radiation entering for example a radio-receiver.

If the receiver is not tuned to the frequency of the radiation it doesn't absorb it.

Infrared radiation, for example, is much more 'tuned' to heat matter than ultraviolet radiation is.

EM radiation is called as such because it has an electric and a magnetic field.

Orbiting electrons create a magnetic field. This field changes when the related electron jumps to another orbit, whether it is to a more inner or more outer orbit.

Logically arguing one can state that thus an external magnetic field, entering an atom, must be able to change the radius of the orbiting electron.

It is like the internal magnetic field in a coil, created by the electric current through this coil, that is disturbed by an external magnetic field, causing a change in the electric current.

Section 2 closes with the intermediate conclusion that the temperature of the surroundings of the matter under consideration is as important as well. The here proposed model is not in contradiction with this conclusion: it is generally accepted that faster moving atoms in the surroundings *directly* activate the atoms of the matter to higher velocities.

## 5 The discrete radii and the phenomenon ‘temperature’

Bohr’s atomic model prescribes that electrons orbit the atomic nucleus at discrete radii, mathematically presented by  $r_n = n^2 a_0/Z$ , with  $n$  an integer and  $Z$  the atomic number. The radius  $a_0$  is the so-called Bohr radius, the smallest in the hydrogen atom. Orbit number  $n$  is supposed to be able to contain a maximum of  $2(n^2)$  electrons.

The idea behind the quantitative presentation of the discrete radii is based on the assumption, for whatever reason, that the angular momentum of the electron  $mvr_n$  is quantized as  $nh/2\pi$ .

In section 4 the following statement has been written:

“Logically arguing one can state that thus an external magnetic field, entering an atom, must be able to change the radius of the orbiting electron and as a result its orbiting velocity.”

Given this argumentation and obeying Bohr’s discrete radii strictly, the consequence in first instance is that the temperature of matter cannot change with arbitrarily small increments. The example shown in section 3 with one atom emphasizes this conclusion. This example shows that the orbital velocity of the electron is 1000 times larger than the velocity of the atom.

In Bohr’s atomic model the electron can only jump from one orbit to another orbit in the range  $r_n = n^2 a_0/Z$ . It is seductive to argue now that the velocity of the atom can also only change abruptly and thus the temperature. But that conclusion is only correct in case of one or a few atoms/elements in a very small volume under consideration.

In a real ideal gas the number of elements in a normal volume is enormous. And such a gas contains another property, shown in reference [1]: the Maxwell-Boltzmann distribution of atomic velocities ( $v$ ), expressed by:  $f(v) = 4\pi v^2 (m/2\pi k_B T)^{3/2} \exp(-1/2 mv^2/k_B T)$ .

Graphs of  $f(v)$  are shown in the figure 1.

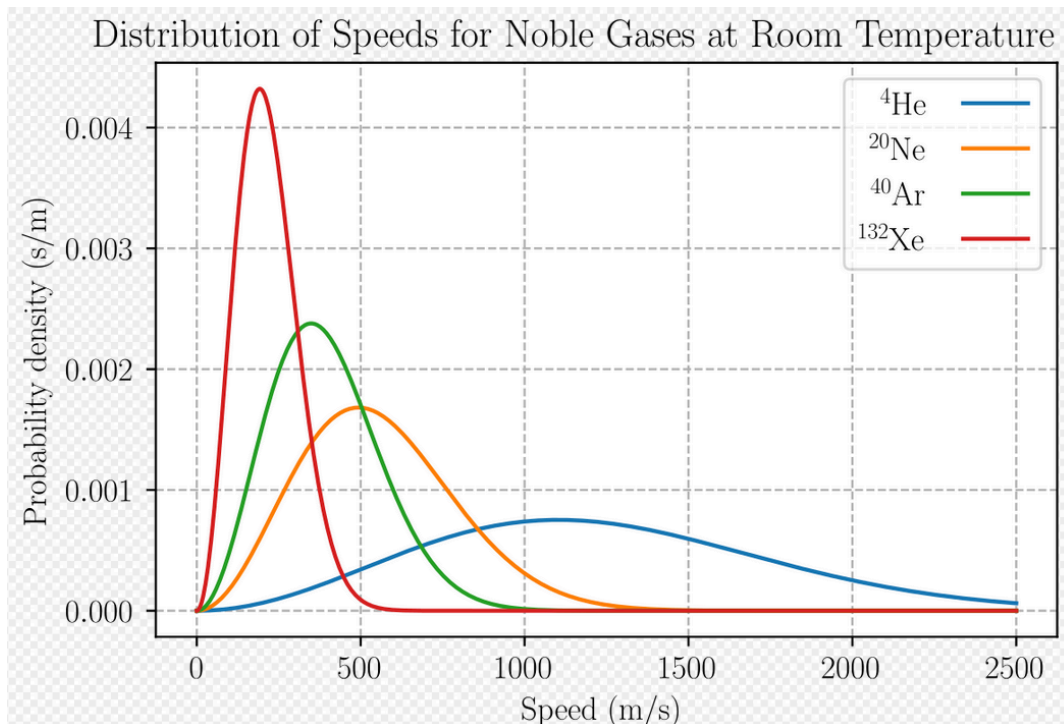


Figure 1 Maxwell-Boltzmann distribution

Three possible kind-of-mean values can be calculated from this distribution:

the most probable:  $v_p = \sqrt{2k_B T/m}$

the mean:  $v_{\text{mean}} = \sqrt{8k_B T/\pi m}$

the root-mean-square:  $v_{\text{rms}} = \sqrt{3k_B T/m}$ .

The total kinetic energy of the gas its N elements is respectively:

$$N \cdot \frac{1}{2} m v_p^2 = N k_B T$$

$$N \cdot \frac{1}{2} m v_{\text{mean}}^2 \sim 1.3 N k_B T$$

$$N \cdot \frac{1}{2} m v_{\text{rms}}^2 = 1.5 N k_B T$$

The ideal gas law shows:  $E = N k_B T$ , so the most probable velocity is the most fitting too.

Figure 1 shows that the heavy element Xe has a low  $v_p$  (with a high probability) opposite to the  $v_p$  of the light element He. In the electron configuration of Xe the outer electrons orbit at a higher orbit than in the one of He, both considered at the same temperature of the gas. So the outer electrons of Xe orbit with a lower orbital velocity than the outer electrons of He. As shown in section 3 the atomic speed  $v_p$  of Xe will thus be lower than of He. So the theory presented in section 4 is supported by the theory behind the Maxwell-Boltzmann distribution.

But the most important conclusion is that the temperature of a large gathering of elements in an ideal gas can, thanks to the Maxwell-Boltzmann distribution of the velocities of the elements, be changed gradually, notwithstanding the quantized character of Bohr's atomic model.

However the pressing question, why are orbits quantified, lingers. Especially due to this unnatural behaviour. Indeed, unless we define such a behaviour as natural, like in modern physics.

## Conclusions

- 1 Just like an orbiting electron in an atom, jumping to an outer orbit, creates EM radiation, external EM radiation will, by means of its magnetic field, be able to force electrons to smaller respectively larger orbits, resulting in higher resp. lower orbital velocities.
- 2 The intrinsic energy level of an atom increases, resp. decreases, as a result of an increasing, respectively decreasing orbital velocity of the electron.  
N.B. The mainstream opinion is the opposite, due to a fundamental misconception of the phenomenon 'potential energy', especially in orbiting configurations. See chapter VII.
- 3 Higher orbital velocities cause higher velocities/vibrations of the atoms, due to mutual collisions and such atoms represent higher temperatures.

## Reference

- [1] [https://en.wikipedia.org/wiki/Maxwell-Boltzmann\\_distribution](https://en.wikipedia.org/wiki/Maxwell-Boltzmann_distribution)

## XXVII Quantum Electro Dynamics: a Fully Fuzzy Fantasy

*Summary - Quantum Electro Dynamics (QED) is one of the products of physics since Einstein. This chapter argues why it is what the title shows.*

### Argumentation

The most eye-catching pronouncement, at least to the opinion of the author, in the field of QED is the created phenomenon “quantum vacuum state”.

Ref. [1] writes:

“In quantum field theory, the quantum vacuum state (also called the quantum vacuum or vacuum state) is the quantum state with the lowest possible energy. Generally, it contains no physical particles. Zero-point field is sometimes used as a synonym for the vacuum state of an individual quantized field. According to present-day understanding of what is called the vacuum state or the quantum vacuum, it is "by no means a simple empty space". According to quantum mechanics, the vacuum state is not truly empty but instead contains fleeting electromagnetic waves and particles that pop into and out of existence.”

### Comment:

In order to find out what is really written / meant in the first sentence, it is necessary to look for the definition of “quantum state”.

Ref. [2] writes:

“In quantum physics, quantum state refers to the state of an isolated quantum system.”

### Comment:

The description in [2] continues with several pages of more descriptions with an uncountable number of references. But in order to find out what is really meant, assumed that such will be possible at all, it is in the first place necessary to look for the definition of quantum system.

Ref. [3] writes:

“A quantum system is a portion of the whole Universe (environment or physical world) which is taken under consideration to make analysis or to study for quantum mechanics pertaining to the wave-particle duality in that system. Everything outside this system (i.e. environment) is studied only to observe its effects on the system. A quantum system involves the wave function and its constituents, such as the momentum and wavelength of the wave for which wave function is being defined.”

### Comment:

In stead of leading to a kind of physics that is at least roughly understandable, it only results in an exponential increase of more undefined phenomena. So the comment here will be continued with scrutinizing the rest of the original text from [1].

Ref. [1] further claims that quantum vacuum state generally contains no physical particles. That means that now and then it thus contains such particles.

The last sentence indeed confirms this: “it contains.....and particles that pop into and out of existence”. As soon as particles would do so, it is no more vacuum, leading to the consequence that the “theory” contradicts itself.

Ref. [1] continues with: “According to present-day understanding of what is called the vacuum state or the quantum vacuum, it is "by no means a simple empty space”.”

If the quantum vacuum is “not a simple empty space”, then, given the fact that vacuum is, by definition, simply an empty space, the word “vacuum” in quantum vacuum, quantum vacuum state and vacuum state is at least a misleading addition. But leaving it out leads to meaningless words.

The last sentence that has been copied from [1] sounds:

“According to quantum mechanics, the vacuum state is not truly empty but instead contains fleeting electromagnetic waves and particles that pop into and out of existence.”

Mind you: “fleeting electromagnetic waves”. Other words for “fleeting” are: volatile, cursory, flighty, fugitive, casual, quick, fast, rapid, swift, speedy, nimble and spry.  
No word at all shows any relation with common sense physics.

One sentence from [1] has yet not been scrutinized:

“Zero-point field is sometimes used as a synonym for the vacuum state of an individual quantized field.”

Ref. [4] tells us about zero-point field the following story:

“All these fields have zero-point energy. These fluctuating zero-point fields lead to a kind of reintroduction of ether in physics, since some systems can detect the existence of this energy. However this ether cannot be thought of as a physical medium if it is to be Lorentz invariant such that there is no contradiction with Einstein's theory of special relativity.”

“Physics currently lacks a full theoretical model for understanding zero-point energy; in particular the discrepancy between theorized and observed vacuum energy is a source of major contention. Physicists Richard Feynman and John Wheeler calculated the zero-point radiation of the vacuum to be an order of magnitude greater than nuclear energy, with a single light bulb containing enough energy to boil all the world's oceans.”

Are there more words to be spent on this “fantastic” physics?

Chapter XXII shows that, as a result of a fundamental misunderstanding/definition of the phenomenon “potential energy”, a countless number of “fantastic” physics has been created, starting with the rejection of the Rutherford-Bohr model in favour of the Heisenberg-Schrödinger model, eventually resulting in many more unsolved physical problems than solutions.

## References

- [1] [https://en.wikipedia.org/wiki/Vacuum\\_state](https://en.wikipedia.org/wiki/Vacuum_state)
- [2] [https://en.wikipedia.org/wiki/Quantum\\_state](https://en.wikipedia.org/wiki/Quantum_state)
- [3] [https://en.wikipedia.org/wiki/Quantum\\_system](https://en.wikipedia.org/wiki/Quantum_system)
- [4] [https://en.wikipedia.org/wiki/Zero-point\\_energy](https://en.wikipedia.org/wiki/Zero-point_energy)

## XXVIII Revised principle of the Sagnac interferometer

*Summary - This chapter describes the behavior of the Sagnac interferometer, based on irrefutable physics. It also shows that the fiber optic gyroscope does not operate like this interferometer.*

### 1 Introduction

Sagnac presented, in the period 1910 to 1913, as fundamental reason for the outcome of his experiment with a rotating interferometer the phenomenon ether wind. See the title of [1].

He used the outcome of his experiment also in order to prove the existence of the luminous ether, notwithstanding, but most likely because of his objection against, Einstein's rejection of this ether in 1905. See the title of [2].

Sagnac doesn't mention at all Einstein's Special Theory of Relativity (STR) in his papers.

It will be shown that he didn't mean an ether wind in the sense Fresnel introduced in 1818.

Fresnel introduced the ether wind by assuming that a moving medium forces its containing ether to move too, resulting in a changing speed of light relative to the 'absolute in rest' ether.

After Einstein came up with his STR, Sagnac's explanation of the outcome of his experiment didn't get any attention anymore. The STR was and is still supposed to explain this outcome.

The same happened with Fresnel's ether wind.

In the following considerations it will be shown that Sagnac his explanation indeed is incorrect, in fact weird, and that Fresnel his expression is correct, but that it has to and can be interpreted without the ether as reference. Fizeau proved this experimentally in 1851, so retrospectively.

The outcome of Sagnac his experiment will be explained based on irrefutable physics.

Finally it is shown why the Fiber Optic Gyroscope does not operate like a Sagnac interferometer.

### 2 Relevant historical background information

#### 2.1 Fresnel's expression for the velocity of light in a moving medium

Fresnel deduced the following expression for the velocity of light in a moving tangible medium.

$$c_m' = c_m + v(n^2 - 1)/n^2$$

This expression shows the drag coefficient of Fresnel. He deduced this expression, assuming that the 'medium' ether was necessary for the propagation of light and at the same time assuming it as an absolute reference for whatever velocity. So all three velocities shown in the expression above are meant to have this ether as reference. He used the following (translated) words:

*“ The medium ether is in absolute rest, except in a transparent medium, in which it moves at a speed  $v(n^2-1)/n^2$ , with  $v$  the velocity of that medium w.r.t. the mentioned absolute reference. ”*

The confusing part of this statement is that there are two ethers: one is in absolute rest and a small part of it, contained in the moving medium, moves relative to the absolute one.

It must, to the opinion of the author, be considered as an extremely coincidental result, given the fact that the expression is indeed correct\*, but developed by means of a wrong model.

The component  $v(n^2 - 1)/n^2$  is, where applicable, called “ether wind”.

\*

Correct in the sense that all the applied velocities have to be considered as relative to the source of the light, explained closer on the next page.



Fizeau experimentally proved the correctness of Fresnel's expression in 1851 by means of a setup shown in figure 1. This figure and the explaining text below are copied from [3].

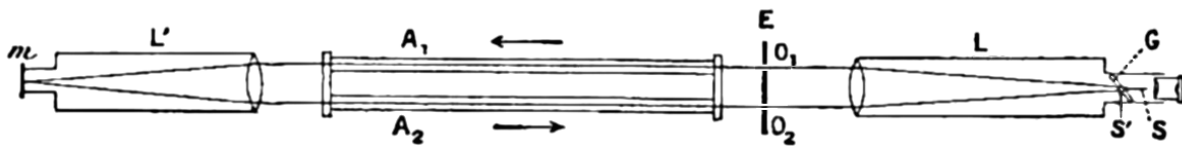


Figure 1 Setup of the Fizeau Experiment

“A light ray emanating from the source S' is reflected by a beam splitter G and is collimated into a parallel beam by lens L. After passing the slits O<sub>1</sub> and O<sub>2</sub>, two rays of light travel through the tubes A<sub>1</sub> and A<sub>2</sub>, through which water is streaming back and forth as shown by the arrows. The rays reflect off a mirror m at the focus of lens L', so that one ray always propagates in the same direction as the water stream, and the other ray opposite to the direction of the water stream. After passing back and forth through the tubes, both rays unite at S, where they produce interference fringes that can be visualized through the illustrated eyepiece. The interference pattern can be analyzed to determine the speed of light traveling along each leg of the tube.”

It is clear that the reference for all velocities in this experiment is, for example, also the source of the light, because no optical component moves relative to the source except the water. Applying this conclusion to the expression of Fresnel results in the following definitions:

$$c_m' = c_m + v(n^2 - 1)/n^2$$

with  $v$  : velocity of the medium w.r.t. the source  
 $n$  : refractive index of the medium  
 $c$  : velocity of light w.r.t. its source in vacuum  
 $c_m$  : velocity of light through the medium w.r.t. its source for  $v = 0$  ( $c_m = c/n$ )  
 $c_m'$  : velocity of light through the medium w.r.t. its source for  $v \neq 0$

So instead of using Fresnel's description:

*“The medium ether moves in a transparent (tangible) medium at a speed  $v(n^2-1)/n^2$  w.r.t. the absolute ether”,*

we will now use:

The velocity  $c_m$  of light through a medium, w.r.t. its source, changes with the amount  $v(n^2-1)/n^2$ , if the medium moves with velocity  $v$  w.r.t. this source. The medium drags the light (a bit).

The sign of  $v(n^2-1)/n^2$  is determined by the direction of  $v$  in relation to the direction of the propagation of the light.

By defining the source as the reference for the velocity of light and for the velocity of the medium, Fresnel's expression can be maintained without any restriction.

## 2.2 Sagnac's explanation of the outcome of his experiment

Given the fact that his interpretation is based on the existence of ether and ether winds, it will only shortly be presented by means of copies from his translated papers:

[1] “In a system in general motion with respect to the ether, the propagation time between any two points of the system must be altered as if the system were motionless and subjected to the action of an ether wind...”

“The vortex of air, analogous and less intense, that the interferometer produces when turning, therefore does not act appreciably. The interference effect observed is indeed the optical swirling effect due to the movement of the system with respect to the ether ...”

Sagnac rejects at this point the phenomenon ether wind in the sense as presented by Fresnel. Unavoidable, because there is no appreciable circularly moving air generated.

He introduces an ‘optical swirling effect’ without any argumentation and emphasizes this in [2]:

“Sense and magnitude of the optical swirling effect. - In the hypothesis of the Fresnel ether, the light waves T and R propagate in the vacuum ether with a speed  $V_0$  independent of the overall motion of the interferometer; the phase of the T-wave direction of propagation clockwise (see the figure) is altered along the closed circuit, as if the luminous ether was driven in a swirl-clockwise, when the circuit turns in the direction.....”

It has to be concluded that Sagnac fantasized a whirling ether wind, rotating synchronously with the disc of his interferometer, meant to increase the velocity of the one beam as well as to decrease the velocity of the other beam. This has to be qualified as a strange way of performing science.

His mathematical expressions, meant to predict the phase difference, are therefore worthless too.

### 3 Revised principle of the Sagnac interferometer

The schematic diagram of the Sagnac interferometer (SIM), as used by him, is shown in figure 2.

In this diagram the symbol  $j$  is the point where the clockwise (cw) and counter clockwise (ccw) light beams, indicated by T respectively R, are created.

In the considerations hereafter this point will be given the symbol S, symbolizing the eventually relevant source of these two light beams. It also is the point where the two beams finally interfere.

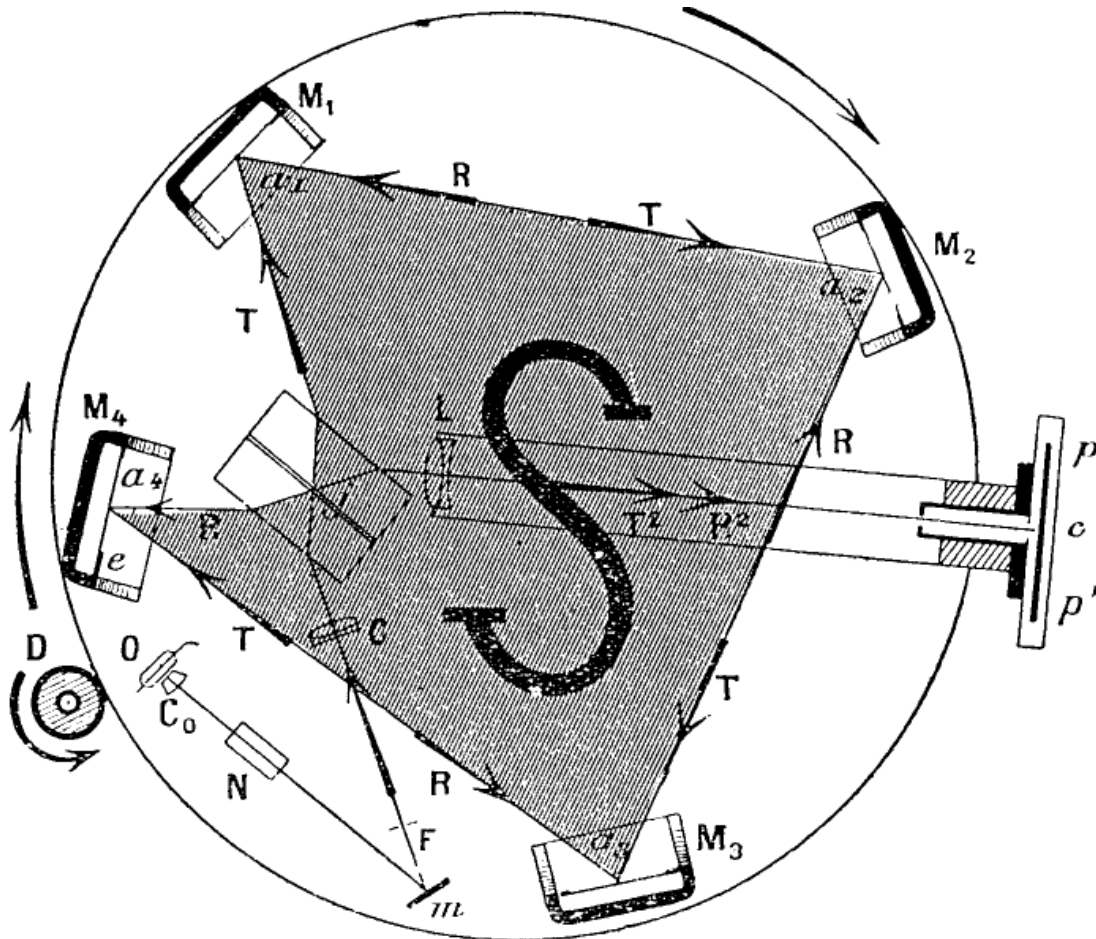


Figure 2

Sagnac used the symbol **S** to indicate the area enclosed by the beams T and R.

He considered the surface of this area as crucial for his mathematical expressions.

For the ease of the consideration below the experiment is supposed to be carried out in vacuum.

In figure 3 the reflections on the mirrors  $M_1$  and  $M_2$  have been drawn in the situations that the disc has been rotated with  $\theta$  respectively  $\Phi$ , compared to no rotation. During the time that the light moves from S to  $M_1$  the disc rotates with  $\theta$ . It rotates with  $\Phi$  while it moves from  $M_1$  to  $M_2$ .

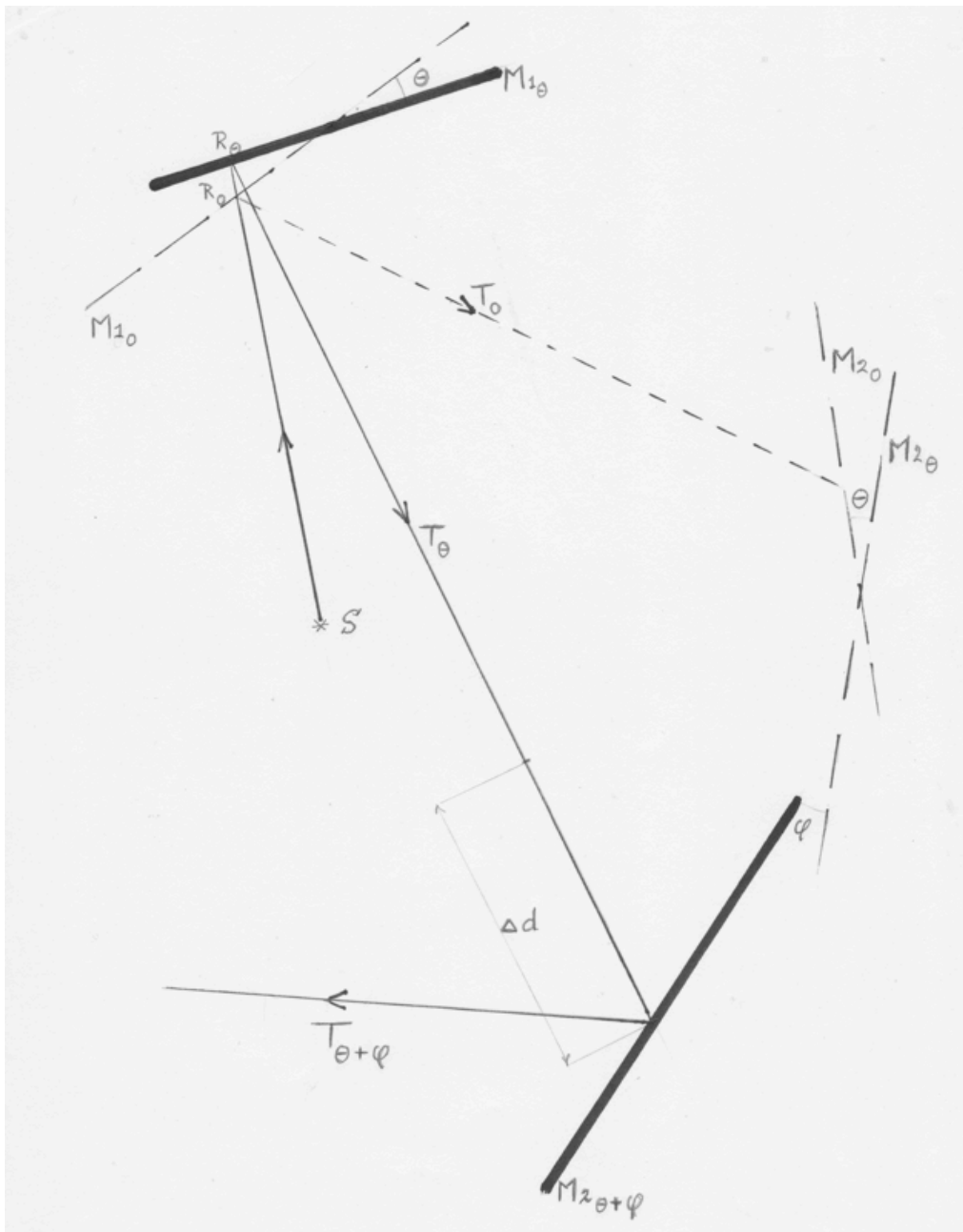


Figure 3

The light propagates with velocity  $c$  relative to S, as well as relative to all mirrors at reflection.

The mirror  $M_1$  is, after arrival of the light there, not anymore at the position where it was at the moment the light left S, neither is it oriented anymore in the direction it was at that moment.

As a result this beam is reflected at point  $R_\theta$  at  $M_1$ .

The same applies for  $M_2$  in the situation that the light moves from  $M_1$  to  $M_2$ .

At the moment the light leaves S, resp.  $M_1$ , it propagates independently from S, resp.  $M_1$ . That means: whatever the velocity, acceleration or displacement of S, resp.  $M_1$  might be after the emission / reflection, the light continues its way as if its Source, resp. Mirror does not exist anymore.

In this extremely exaggerated drawing, representing an extremely high angular speed, the reflection at  $M_1$  significantly moves away from the point on  $M_1$  in case of no rotation.

If  $S$  and  $M_1$  would, as such a rigid combination, not rotate but only translate with a constant speed, in whatever direction w.r.t. the direction of propagation of the light, the position of the point of reflection at  $M_1$  would not change. Eventually this is the consequence of the property of an inertial system of which its velocity  $v$  cannot be determined by an observer located *in* this system. Well known as the Galilean's Principle of Relativity. See chapter I.

The fundamental reason for this phenomenon is that no reference is available for that  $v$ .

In case the translation would happen in, for example, air, the expression of Fresnel shows that, due to the velocity  $v$  of the construction, the velocity of the light relative to  $S$ , and thus relative to  $M_1$  too, will change from  $c_m$  to  $c_m + v(n^2 - 1)/n^2$ , with  $c_m = c/n$ . In this situation the reference for the velocity  $v$  is the air!

Figure 3 shows that the cw rotation of the interferometer causes a longer distance for the cw traveling light to propagate from  $R_\theta$  at  $M_1$  to  $M_2$ . While the light propagated from  $S$  to  $M_1$  mirror  $M_2$  of course also rotated with  $\theta$ . The rotation  $\Phi$  is obtained during the time the light propagates from  $R_\theta$  to  $M_2$ . Let  $T_0$  represent the length of the optical path between  $R_0$  and  $M_{20}$ , and  $T_\theta$  the one between  $R_\theta$  and  $M_{20+\Phi}$ , then  $\Delta d$ , shown in figure 3, equals  $T_\theta - T_0$ .

Such an increasing length of the optical path is created at  $M_3$  and successively at  $M_4$  too.

Figure 3 shows that the increase obtained at  $M_1$  is fully negligible compared to  $\Delta d$ , so effectively only rotation causes the difference in the optical path lengths.

This total increase of optical path length is amplified by a factor 2 due the fact that the ccw beam results in the same but *decreased* path length. Together they cause the eventual interference.

Figure 3 shows that a calculation of the final path length difference will be complex and if the mathematical expression would be found it would contain a 'countless' number of parameters.

#### 4 The ring laser gyroscope

The ring laser gyroscope uses basically the same principle of working: rotating source and mirrors at a rigid construction. The detection of interference is essentially different.

So its principle operating doesn't need more attention in this section.

#### 5 The fiber optic gyroscope (FOG)

The principle of the FOG is in essence different from the principle of the SIM, because in the FOG the light is forced to follow a circular way by the shape of the fiber. Secondly: the FOG works in the multi mode as well as in the single mode version. In the single mode version the propagation is straight through the centre of the fiber, while in the multi mode version the propagation is via reflections at the inside of a tube, similar to the propagation in a waveguide. These reflections suggest a similarity with the SIM, but this is certainly not the case, as follows from the detailed description of this interferometer above. Shortly expressed: in the SIM the light moves independently from the reflectors in between these reflectors, while in the multi mode FOG the light moves from reflector to reflector, forced by the shape of the reflecting inner side of the mentioned tube.

So, given the fact that the FOG also works in single mode, the conclusion must be that reflections, like just described, seemingly don't play any role in the process.

For that reason another fundamental process will be investigated, in which it assumed that the source of both beams does not move relative to medium glass inside the fiber. This medium moves with the velocity  $\omega.r$ , with  $\omega$  the angular speed of the fiber coil and  $r$  its radius.

This assumption is based on the configuration in which the source is supposed to be placed in or near the centre of the rotating fiber coil and thus will not experience the velocity  $v$ .

Based on this assumption we can now write:

$$\begin{aligned} c_{mcw}' &= c_m + v(n^2 - 1)/n^2 && \text{for the cw beam and} \\ c_{mccw}' &= c_m - v(n^2 - 1)/n^2 && \text{for the ccw beam} \end{aligned}$$

with  $c_m = c/n$

and  $n$  the index of refraction of the applied glass.

The difference in time at the moment of interference between the two beams is:

$$\Delta t \approx v(n^2 - 1)/n^2 \cdot (2L/c_m^2) \text{ with } L \text{ the length of the fiber.}$$

If  $L = 500 \text{ m}$ ,  $r = 0.05 \text{ m}$ ,  $n = 1.5$  and  $\omega = 1 \text{ rad/s}$  then  $\Delta t = 7 \cdot 10^{-16} \text{ s}$ .

In case of a frequency of the light of  $2 \cdot 10^{14} \text{ Hz}$ , the phase shift is  $360 \cdot 7 \cdot 10^{-16} \cdot 2 \cdot 10^{14} = 50$  degrees.

## Conclusions

- 1 Sagnac fantasized an explanation for the outcome of his experiment by introducing, without any argument, the phenomenon optical swirling effect, supposed to represent an ether wind that circulates synchronously with the rotating disc of the interferometer. A most weird approach, without any scientific value.
- 2 If Sagnac's mathematical expressions would predict correctly the shift of the interference patrons, then this result must be considered as extremely coincidental.
- 3 The principle operating of the Sagnac interferometer can simply be established, without applying any 'special relativistic' phenomenon, by drawing the path that the light will follow from the source, via the first mirror, to the second mirror, in a situation representing an unrealistic high angular velocity.
- 4 The Ring Laser Gyroscope also operates principally in this way, but the interference is realized significantly different.
- 5 The Fiber Optic Gyroscope operates not at all like the Sagnac interferometer. It has been made plausible that the principle represented by Fresnel's expression for the velocity of light in a moving medium most likely explains its successful operating.
- 6 The Michelson & Morley (M&M) interferometer is based on the same principle as the Sagnac interferometer. However, even if M&M had placed their instrument on top of one of the poles of earth, its angular speed would have been 1 rev/24 hours. Sagnac applied a few rev/second in order to create visible shifting interference patterns.

## References

- [1] PHYSICAL - The luminous ether demonstrated by the effect of the relative wind of ether in an interferometer in uniform rotation. Note by Mr. G. SAGNAC, presented by Mr. E. Bouty. [https://fr.wikisource.org/wiki/L'éther\\_lumineux\\_démontré](https://fr.wikisource.org/wiki/L'éther_lumineux_démontré)
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## XXIX From Maxwell's equations to electromagnetic waves

*Summary - This chapter shows how electromagnetic source and wave are related and why the propagation velocity of light in vacuum is  $c$ , exclusively relative to its source.*

### 1 Introduction

Starting with the explanation of the most basic concepts: static electric and magnetic fields, the Maxwell equations for the dynamic fields are shown to be hypotheses instead of laws. These hypotheses are used to show mathematically how an EM wave must look like. For this study reference [1] has been used as guidebook.

### 2 The static electric field

#### 2.1 From force to voltage

About two and a half centuries ago Coulomb discovered the repulsive force between like electrical charges objects and the attractive force between unlike charged objects. Just like Newton discovered the attractive force between masses.

The last mentioned one has been mathematically expressed as  $F_G = GMm/r^2$ , with  $[G]$  is  $Nm^2kg^{-2}$ . The distance between the centres of the objects is defined as  $r$ .

Coulomb's force has been mathematically expressed in basically exactly the same way by means of  $F_C = \kappa Qq/r^2$ , with  $\kappa = 1/4\pi\epsilon$  and  $\epsilon$  the so-called dielectric permittivity of the medium in which the objects are located. As a result the dimension of  $\kappa$  is  $Nm^2C^{-2}$ . The dimension of  $\epsilon$  thus is:  $N^{-1}m^{-2}C^2$ . Let for the ease of the considerations  $Q$  be the main object and  $q$ , *being much smaller*, the object in the sphere of influence of  $Q$ . The charge  $q$  is supposed to be small enough to have negligible influence on the sphere of influence of  $Q$ .

Let us describe that sphere of influence of  $Q$  by means of the words 'electric field' of  $Q$ . Such a field has, according to Coulomb's experiences through his experiments, the possibility to attract or repulse an object with an electric charge of  $q$ . Let us call the strength of this field  $E_r$  at the distance  $r$  from  $Q$  and the related force  $F_{Cr}$ . So  $F_{Cr} = qE_r$ .

Given the relation  $F_{Cr} = \kappa Qq/r^2$ , the electric field strength  $E_r$  has to be presented as  $E_r = \kappa Q/r^2$ . Given the dimension of the variables on the right side of the equation, the dimension of  $E_r$  is  $N/C$ .

Remark:  $N/C$  can also be written as:  $Nm/Cm = VAs/Cm = VC/Cm = V/m$ , because  $Nm$  and  $VAs$  are both expressions for energy, so the dimension of  $E_r$  is also  $V/m$ , as normally used.

In order to move, in the electric field of  $Q$ , the object  $q$  from  $P_1$  to  $P_2$ , the integral  $\int_s qE_s ds$  represents the work that has to be carried out in order to do so. The quantity  $qE_s$  represents at any place on that path the force in the direction of the movement. The total mentioned work thus equals the difference in *potential energy* in the two chosen points.

If the path is a closed curve, the result must be zero, so  $\oint_s qE_s ds = 0$  and thus  $\oint_s E_s ds = 0$ . \*

The quantity  $E_s ds$  represents a voltage/potential, so  $\int_s E_s ds$  from  $P_1$  to  $P_2$  results in  $V_{P_2} - V_{P_1}$ , the difference in voltage between the points  $P_1$  and  $P_2$ .

\* The symbols  $\oint_s$ , resp.  $\int_s$  are used to express a line integral along a closed, resp. open curve  $s$ .

## 2.2 The static electric flux

The static electric flux  $\Phi_E$  is also a measure of the electric field strength at any distance from the charge  $Q$ , in the sense of the amount of electric field *through a certain surface*.

The mathematical presentation is  $\Phi_E = \iint_S E_r dS$  \*, with  $E_r$  perpendicular to surface element  $dS$ .

In case of an electric field equally spread over a sphere around object  $Q$ , the field strength  $E_r$  is the same at each element  $dS$  on that sphere.

So the surface integral at distance  $r$  from  $Q$  is  $4\pi r^2 E_r = 4\pi r^2 \cdot \kappa Q/r^2 = Q/\epsilon$  Vm.

The result effectively shows that, whichever closed surface is chosen around  $Q$ ,  $\Phi_E = Q/\epsilon$ .

## 2.3 The static dielectric flux

The expression in 2.2 for the static electric flux can also be written as:  $Q = \iint_S \epsilon E_r dS = \iint_S D_r dS$

The variable  $D$  is normally used as symbol for dielectric displacement.

This name will be commented in section 3.

The equation shows that the dimension of  $D_r$  (from now on written as  $D$ ) equals the dimension of  $\epsilon E_r$  ( $E_r$  from now on written as  $E$ ) and  $Q/S$ , being  $Cm^{-2}$ .

Differentiating to time, the equation  $D=Q/S$  results in:  $dD/dt = dQ/dt/S = I_D/S$ , with  $I_D$  used as symbol for dielectric current. But  $dQ/dt$  in a *static* situation is zero.

Therefore the situation has to be transferred to a dynamic one.

## 2.4 The dynamic dielectric flux

In order to obtain a meaningful concept of an electric charge that changes with time, without applying solid conductors in which electrons operate as moving electric charges, we can imagine a moving charge  $Q$  in empty space or tangible medium. In empty space the electric permittivity has to be chosen as  $\epsilon_0$ , in a tangible medium as  $\epsilon_0 \epsilon_r$ , shortly written as  $\epsilon$ , like up to now.

Imagine a charge  $Q$  in a reference system relative to which  $Q$  moves with constant velocity  $v$ , say along the  $x$ -axis. During time  $t$  until  $t+\Delta t$ ,  $Q$  moves from  $x$  to  $x+v\Delta t = x+\Delta r$ . At time  $t$  the electric field strength at distance  $r$  from  $x$  can be expressed as in 2.1:

$$E(t) = \kappa Q/r^2.$$

At time  $t+\Delta t$  the field strength, at this same position relative to  $x$ , is

$$E(t+\Delta t) = \kappa Q/(r-\Delta r)^2$$

So  $E(t+\Delta t)-E(t) = 2\Delta r \kappa Q/r^3$ .

Multiplying both sides with  $\epsilon$ , results in:  $\Delta D/\Delta t = \epsilon 2\Delta r \kappa Q/r^3/\Delta t = vQ/r^3/2\pi$  ( $\epsilon\kappa=1/4\pi$ ).

Multiplying both sides with an arbitrary small surface element  $dS$  results in  $I_D = dSvQ/2\pi r^3$  (A).

In order to look for another approach too, a changing  $Q$  as function of time will be considered from the point of view that  $Q$  does not change its position, but its value.

Suppose at time  $t$  the charge is  $Q$  and at time  $t+\Delta t$  it is  $Q+\Delta Q$ . At distance  $r$  from this changing electric charge,  $D(t)$  is  $\epsilon\kappa Q/r^2 = Q/4\pi r^2$  while  $D(t+\Delta t) = (Q+\Delta Q)/4\pi r^2$

So  $\Delta D/\Delta t = (\Delta Q/\Delta t)/4\pi r^2$   $Cm^{-2}s^{-1} = Am^{-2}$ .

Multiplying both sides with an arbitrary small surface element  $dS$  shows:  $I_D = dS\Delta Q/\Delta t/4\pi r^2$  (A).

This is the moment to start the investigation of magnetic fields, because electric as well as dielectric currents create magnetic fields.

From now on a current can be either an electric or a dielectric current.

\* The symbols  $\iint_S$ , resp.  $\iint_S$  represent the surface integral over a closed, resp. open surface  $S$ .

### 3 The magnetic field

#### 3.1 The static magnetic field

Two types of static magnetic fields will be considered: the one created by a current through an infinite long straight conductor, the other by a circular shaped current.

A straight line current creates a circular shaped magnetic field with this current as centre and in a plane perpendicular to this line. Its strength  $H$  at distance  $r$  from this current is  $I/2\pi r$  (A/m).

A circular shaped current creates a magnetic field through the surface enclosed by this current, perpendicular to this surface. Its strength  $H$  in the centre of this circle is equal to  $I/2r$  (A/m).

Remark about the similarity between electric and magnetic fields:

A fundamental difference between a static electric field and a static magnetic field is that the electric field is an open one, leading to the results:  $\oint_s E ds = 0$  and  $\iint_s E dS = Q/\epsilon = \Phi_E$  (Vm), while the magnetic field is a closed one, leading to the results:  $\oint_s H ds = I$  and  $\iint_s H dS = 0$ .

The last mentioned expression is normally written as  $\Phi_B = \iint_s \mu H dS = \iint_s B dS = 0$ , with  $\Phi_B$  the so-called magnetic flux (Vs) and  $B$  the magnetic flux density (Vs/m<sup>2</sup>).

From the point of view of similarity with the magnetic field it is strange that the electric flux has not been defined as  $\Phi_D = \iint_s \epsilon E dS = \iint_s D dS = Q$ . The dimension of  $\Phi_D$  is As (or C) and of  $D$ , as an electric flux density, still As/m<sup>2</sup>, or C/m<sup>2</sup>.

Such a convention would lead to the following table for static fields:

	Electric field		Magnetic field	
Field strengths	$E$	V/m	$H$	A/m
Medium properties	$\epsilon$	As/Vm	$\mu$	Vs/Am
Flux densities	$D = \epsilon E$	As/m <sup>2</sup>	$B = \mu H$	Vs/m <sup>2</sup>
Flux	$\Phi_D$	As	$\Phi_B$	Vs
Energy densities	$E \cdot D$	J/m <sup>3</sup>	$H \cdot B$	J/m <sup>3</sup>
Physical laws				
Closed curve integrals	$\oint_s E ds = 0$		$\oint_s H ds = I$	
Closed surface integrals	$\iint_s D dS = Q$		$\iint_s B dS = 0$	

#### 3.2 The dynamic magnetic field

The just mentioned equation:  $\oint_s H ds = I$  can simply be proven in case of a straight line current, because  $H = I/2\pi r$  at each point around the current at distance  $r$ , and  $H$  and  $ds$  do have the same direction in each point too, the closed integral along this circle is  $I/2\pi r \cdot 2\pi r = I$ .

Reference [1] at this place declares at page 256:

“Investigation of other magnetic fields finally leads to the conclusion that  $\oint_s H ds = I$ , with  $I$  the sum of all currents enclosed in  $s$ , is a general property of the magnetic field.”

Seemingly a theoretical substantiation of this general property is too complex, maybe even impossible. The expression thus should have been qualified as hypothesis.

Finally the closed curve integral is presented as:  $\oint_s H ds = d/dt \iint_s D dS + \iint_s \gamma E dS$ , with  $\iint_s \gamma E dS$  defined as conduction current.

However the expression is not helpful trying to understand how an EM wave is generated, because an EM wave is normally not generated in fields including conduction currents.

The complete equation is officially called: “Ampère's circuital law (with Maxwell's addition)”, or shortly Maxwell's  $n$ th equation, with ‘ $n$ ’ now-a-days undefined!

In this article only  $\oint_s H ds = d/dt \iint_s D dS$  will be used and called Maxwell-Ampère equation.



Remark:

Before we continue with this equation we have to take care of the fact that the equation  $\Phi_D = \iint_S D \, dS$  concerns a closed surface integral over the charge  $Q$  that creates the electric flux density  $D$  in a static situation, while in  $\oint_S H \, ds = d/dt \iint_S D \, dS$  the electric flux density is supposed to go through an open surface enclosed by the curve 's' meant in the left side of the equation. We thus have to accept even more penetrating that the expression  $\oint_S H \, ds = d/dt \iint_S D \, dS$  is not a law but a hypothesis: valid as long as it has not been proven to be invalid.

The second difference between  $\iint_S D \, dS$  and  $\iint_S D \, dS$  is that the first mentioned one equals  $Q$  in the static situation, while the second one is supposed to be applied in a dynamic situation, given the fact that the differentiation, applied to it, is supposed to be meaningful. The same kind of remark is applicable to the following consideration.

It is generally accepted that a voltage can be generated in a closed wire by changing a magnetic flux through the *open* surface enclosed by the wire, mathematically expressed by  $V = d\Phi_B/dt$ .

This  $\Phi_B$  thus is not the same magnetic flux as in  $\Phi_B = \iint_S B \, dS$ . So just like in the electric situation the relation  $\int_S E \, ds = d/dt \iint_S B \, dS$  should have been qualified as a hypothesis too.

Summarized:

Maxwell-Ampère equation	$\oint_S H \, ds = d/dt \iint_S D \, dS$
Maxwell-Faraday equation	$\int_S E \, ds = d/dt \iint_S B \, dS$

#### 4 The electromagnetic wave

The Maxwell-Ampère equation can also be presented as  $\oint_S H \, ds = d/dt \iint_S \epsilon E \, dS$ ,  
like the Maxwell-Faraday equation can be presented as  $\int_S E \, ds = d/dt \iint_S \mu H \, dS$ .

In this way they clearly show that the generation of an EM wave is based on a feedback loop, unavoidably resulting in an oscillating phenomenon that has led to the generally accepted model with sinusoidal shaped  $E$  and  $H$  fields, in planes perpendicular to each other.

The propagation of these fields is supposed to be like drawn in figure 1, copied from [1] at page 318. An interesting question is whether the mutual phase between these fields is indeed zero, or possibly  $90^\circ$ , shown in figure 2, like the voltage and current in a LC-oscillator.

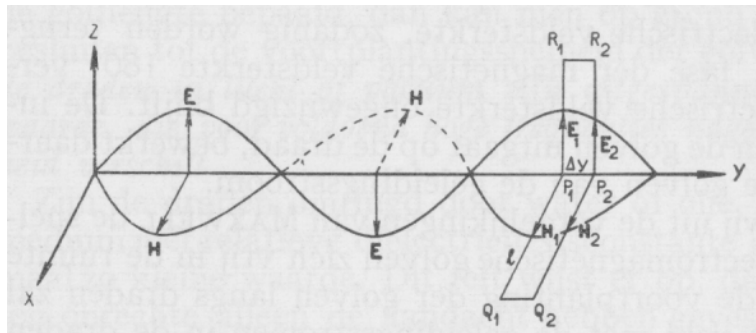


Figure 1 showing zero phase between  $E$  and  $H$  fields

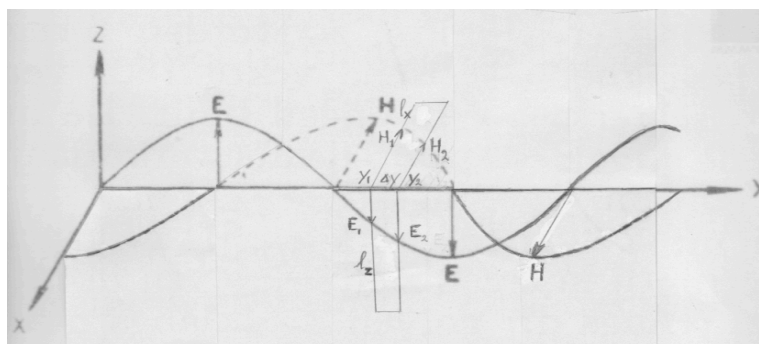


Figure 2 showing  $90^\circ$  phase between  $E$  and  $H$  fields

Reference [1] shows a simple derivation of the speed of light based on figure 1. Such a derivation can also be applied to figure 2. The translation of that derivation, a bit adapted here, is shown. It doesn't matter whether figure 1 or 2 is used.

The propagation direction of the EM wave is assumed to be along the y-axis. The electric resp. magnetic fields at position  $y_1$  resp.  $y_2$  are:  $E_1$  and  $H_1$  resp.  $E_2$  and  $H_2$ . Between these moments the EM wave is supposed to travel the distance  $\Delta y$  during the time  $\Delta t$  with speed  $v = \Delta y / \Delta t$ .

The Maxwell-Ampère respectively Maxwell-Faraday equation applied, leads to:

$$\oint_{\mathcal{S}} \mathbf{H} \cdot d\mathbf{s} = (H_2 - H_1)l_x = d/dt \iint_{\mathcal{S}} \mathbf{D} \cdot d\mathbf{S} = dD/dt \cdot l_z \Delta y = \epsilon dE/dt \cdot l_z \Delta y = \epsilon(E_2 - E_1) / \Delta t \cdot l_z \Delta y = \epsilon v (E_2 - E_1) l_z$$

resp.,

$$\oint_{\mathcal{S}} \mathbf{E} \cdot d\mathbf{s} = (E_2 - E_1)l_z = d/dt \iint_{\mathcal{S}} \mathbf{B} \cdot d\mathbf{S} = dB/dt \cdot l_x \Delta y = \mu dH/dt \cdot l_x \Delta y = \mu(H_2 - H_1) / \Delta t \cdot l_x \Delta y = \mu v (H_2 - H_1) l_x$$

N.B. The electric and magnetic fields in the y-direction are zero!

So  $(H_2 - H_1)l_x = \epsilon v (E_2 - E_1)l_z$  respectively  $(E_2 - E_1)l_z = \mu v (H_2 - H_1)l_x$

To be referred to as “first equation” resp. “second equation”

At this point the difference between figure 1 and 2 shows up!

Suppose we take in figure 2 the places along the y-axis around a maximum H, where  $H_1 = H_2$  and thus around  $E = 0$  where  $E_1 = -E_2$ . At such places  $H_2 - H_1 = 0$ , so the 2 equations are clearly invalid.

Taking figure 1, there are no such places, so this phenomenon is already a sufficient reason to reject the possibility of whatever phase shift between the E and H field, other than  $0^\circ$  or  $180^\circ$ .

Applying the left side of the “first equation” in the right side of the “second equation” shows:

$$(E_2 - E_1)l_z = \mu v \{ \epsilon v (E_2 - E_1)l_z \} = \epsilon \mu v^2 (E_2 - E_1)l_z, \text{ so } \epsilon \mu v^2 = 1, \text{ resulting in } v = 1/\sqrt{\epsilon \mu}.$$

Reference [1] uses from the beginning the assumption  $l_x = l_z$ . Not doing so in the next step and defining  $\Delta E$  as  $E_2 - E_1$  resp.  $\Delta H$  as  $H_2 - H_1$ , leads to:  $\epsilon (\Delta E l_z)^2 = \mu (\Delta H l_x)^2$ .

A basically correct approach would be to chose  $l_x$  as well as  $l_z$  infinite, resulting in  $\Delta E = \Delta H \sqrt{\mu/\epsilon}$ , with  $\sqrt{\mu/\epsilon}$  the so-called characteristic impedance of the medium under consideration.

Such an outcome also forces to conclude that the E and H fields must be synchronized *in phase*.

A much more important conclusion of this consideration is the confirmation of the remark made already at the beginning:

“Because an electric charge is a quantity that can exist independent of other quantities, the start of the generation of an EM wave must be found in a source that eventually produces a  $dQ/dt$ .”

That means that the very first  $dQ/dt$  is generated in the source of the EM wave, with the conclusion that thus the propagation speed of an EM wave is  $1/\sqrt{\epsilon \mu}$  *relative to its source only*.

Secondly: the larger this  $dQ/dt$ , given the same  $dQ$ , the higher the frequency of the EM wave will be, also confirming that the EM wave and its source are inextricably linked to each other at the moment of emission. In chapter VIII it has already been argued that, given a certain  $\Delta Q$ , the smaller  $\Delta t$  is, the higher the frequency of the emitted photon.

With this conclusion the hypothesis in the Special Theory of Relativity: the speed of light is  $c$  relative to *any* reference, has to be rejected, and thus this theory! See also chapter I.

## 5 The integral and differential presentations of the Maxwell equations

### 5.1 The integral presentation (IP)

In the previous section the IP of the Maxwell equations have been used.

An EM wave is a 3-dimensional phenomenon, so the two variables  $\mathbf{E}$  and  $\mathbf{H}$  and their related variables, are effectively vectors. In figure 1 these variables are presented as 1-dimensional:  $\mathbf{E}$  is only defined in the z-direction, like  $\mathbf{H}$  only in the x-direction.

In order to try to understand what happens 3-dimensionally this caricature has been chosen.

Thus the vectors  $\mathbf{E}$  and  $\mathbf{H}$  and their related variables have been presented and used as  $E$  resp.  $H$ .

Consequently these variables will not leave the x-z plane, thus do not show any propagation of the EM wave out of the source.

Centuries old experiences have learned that these fields do, for some not yet explained reason, not stay in that one plane. The most likely reason is that an E/H field doesn't cause a H/E field as one line exactly perpendicular to E/H, as suggested up to now. For example, a circular shaped electric current creates H fields curving around this current as closed loops.

So indeed figure 1 is a caricature of reality.

### 5.2 The differential presentation (DP)

This presentation is as follows:

$\nabla \cdot \mathbf{E} = \rho/\epsilon$	in stead of	$\iint_S \mathbf{E} \, dS = Q/\epsilon$	$[\rho]=Q/m^3)$
$\nabla \cdot \mathbf{H} = 0$	in stead of	$\iint_S \mathbf{H} \, dS = 0$	
$\nabla \times \mathbf{E} = -\mu \partial \mathbf{H} / \partial t$	in stead of	$\int_S \mathbf{E} \, ds = d/dt \iint_S \mu \mathbf{H} \, dS$	
$\nabla \times \mathbf{H} = -\epsilon \partial \mathbf{E} / \partial t$	in stead of	$\int_S \mathbf{H} \, ds = d/dt \iint_S \epsilon \mathbf{E} \, dS$	

The outcome of  $\nabla \cdot \mathbf{F}$  is the quantity:  $\partial F_x / \partial x + \partial F_y / \partial y + \partial F_z / \partial z$ , with  $\mathbf{F}$  an arbitrary variable.

The outcome of  $\nabla \times \mathbf{F}$  is the vector:  $(\partial F_y / \partial z - \partial F_z / \partial y, \partial F_z / \partial x - \partial F_x / \partial z, \partial F_x / \partial y - \partial F_y / \partial x)$ .

The fundamental problem with these presentations is, at least to the opinion of the author, that in the first instance every feeling with reality is lost.

But  $\nabla \times \mathbf{F}$  can be simplified by looking at it as only a derivative of  $\mathbf{F}$  to 'place'.

Doing so the dimension of  $\mathbf{E}$  changes from V/m to V/m<sup>2</sup> resp. the one of  $\mathbf{H}$  from A/m to A/m<sup>2</sup>.

In the IP situation on both sides of the equation the dimension is V, resp. A. So, from that point of view there is no principle difference between the two types of presentation.

The DP shows, after applying esoteric  $\nabla$  operations:  $\partial^2 E / \partial t^2 = \epsilon^2 \nabla^2 E$  and  $\partial^2 H / \partial t^2 = \epsilon^2 \nabla^2 H$ .

Reference [2] presents the following information about such a type of equation:

“Solutions of this equation describe propagation of disturbances out from the region at a fixed speed in one or in all spatial directions, as do physical waves from plane or localized sources; the constant  $c$  is identified with the propagation speed of the wave.”

*Seemingly the speed  $c$  with respect to its “localized source” is meant!*

The IP thus is much more clear and much more related to reality in proving that  $c = \sqrt{1/\epsilon_0 \mu_0}$ .

The DP does neither show any indication about the mutual phase between the E and H fields!

It shows that if  $\partial \mathbf{H} / \partial t = 0$  then  $\nabla \times \mathbf{E} = 0$ . But  $\nabla \times \mathbf{E}$  is in the most simple imagination  $dE/d'$ place', not being able to specify 'place' better than an unknown direction at an unknown position.

### Conclusion

The article shows in the simplest way how the EM wave can mathematically be deduced from the Maxwell-Ampère and Maxwell-Faraday equations, with, as spin of, the evidence that the reference for the propagation speed of an EM wave can only be its source.

Such a conclusion forces to reject the Special Theory of Relativity.

### References

- [1] Leerboek der natuurkunde, Prof. Dr. R. Kronig, Delft, 1962 (in Dutch)
- [2] [https://en.wikipedia.org/wiki/Wave\\_equation](https://en.wikipedia.org/wiki/Wave_equation)

# XXX Special Theory of Relativity based on fraudulent science?

*Summary -This chapter makes it highly likely that the question mark in the title has to be an exclamation mark.*

## 1 Introduction

Section 2 shows that Einstein's mistakes in his mathematics in the Special Theory of Relativity are so extremely obvious that one can hardly believe that he didn't make them purposely.

Section 3 shows that the scientific establishment changed, after his death, Einstein's hypothesis regarding the speed of light fundamentally, but that it maintained, uncriticised, the result of his theory.

## 2 Einstein's unpardonable mistakes

If Einstein would not have made these mistakes he would not have succeeded in presenting his consistent transformation formulas. 'Consistent' regarding the following property: after having transformed the coordinates  $x$  and  $t$  from system  $K$  to system  $k$  ( $k$  moves with velocity  $v$  relative to  $K$ ), the original coordinates in  $K$  are found again applying the same formulas with the appropriate variables from  $k$  to  $K$ . These mistakes will be shown in the Italic texts copied from ref [1], being a correct translation of ref [2].

Einstein defined the velocity  $v$  as follows:

*Now to the origin of one of the two systems ( $k$ ) let a constant velocity  $v$  be imparted in the direction of increasing  $x$  of the other stationary system ( $K$ ), and let this velocity be communicated to the axes of the co-ordinates, the relevant measuring rod....*

At the start of § 3 in his article, he writes:

*If we place  $x'=x-vt$ , it is clear that a point at rest in the system  $k$  must have a system of values  $x', y, z$ , independent of time.*

This is a contradiction in itself, because  $x' = x - vt$  shows that  $x'$  is a function of time. Unless  $x$  would be  $x_0 + vt$ , with  $x_0$  independent of time! So the question is: what has  $x$  been meant to be?

To answer this question the final result of the STR has to be considered, especially:  $\xi = \beta(x - vt)$ .

Suppose  $x = x_0 + vt$ , then  $\xi$  would be  $\beta x_0$ . This has, for sure, not been the purpose of the STR.

The transformation  $\xi = \beta(x - vt)$  can, given the relation  $x' = x - vt$ , be written as  $\xi = \beta x'$ . This result is in accordance with the purpose of the STR, meant to show that, due to the velocity  $v$  between  $k$  and  $K$ , the projection of  $x$  in  $k$  is not just  $x'$ , but an enhanced value  $\beta x'$ . Given the fact that  $\beta = 1/\sqrt{1-v^2/c^2}$ , this projection is only  $x'$  if  $v$  would be zero!

Conclusion: Einstein's description has to be ignored, except the definition  $x' = x - vt$ , with  $x \neq x_0 + vt$ .

In the following text of Einstein it is found that he chose  $x = ct$ , because he introduces there  $x' = ct - vt$ .

**It will be shown that this has been meant as the first step in Einstein's manipulative mathematics**

*Since  $\tau$  is a linear function, it follows from these equations that*

$$\tau = a \{t - vx' / (c^2 - v^2)\}$$

*where  $a$  is a function  $\varphi(v)$  at present unknown, and where for brevity it is assumed that at the origin of  $k$ ,  $\tau=0$ , when  $t=0$ .*

*With the help of this result we easily determine the quantities  $\xi, \eta, \zeta$  by expressing in equations that light (as required by the principle of the constancy of the velocity of light, in combination with the principle of relativity) is also propagated with velocity  $c$  when measured in the moving system. For a ray of light emitted at the time  $t = 0$  in the direction of the increasing  $\zeta$*

$$\zeta = c\tau \text{ or } \zeta = ac \{t - vx' / (c^2 - v^2)\}$$

*But the ray moves relatively to the initial point of  $k$ , when measured in the stationary system, with the velocity  $c-v$ , so that*

$$x' / (c - v) = t.$$

If we insert this value of  $t$  in the equation for  $\xi$ , we obtain

$$\xi = ac^2x' / (c^2 - v^2)$$

Hereafter it will be shown that Einstein has made this exceptional transformation on purpose.

In an analogous manner we find, by considering rays moving along the two other axes, that

$$\eta = c\tau = ac\{t - vx' / (c^2 - v^2)\}$$

when

$$y/\sqrt{c^2 - v^2} = t, \quad x' = 0.$$

Thus

$$\eta = acy/\sqrt{c^2 - v^2} \quad \text{and} \quad \zeta = acz/\sqrt{c^2 - v^2}$$

Here Einstein introduces, without any explanation, a velocity of light  $\sqrt{c^2 - v^2}$  along the  $y$ - and  $z$ -axis.

**Such a velocity is contrary to his own hypothesis and thus extremely unscientific.**

He continues with:

*Substituting for  $x'$  its value, we obtain*

$$\tau = \varphi(v)\beta(t - vx'/c^2)$$

$$\xi = \varphi(v)\beta(x - vt)$$

$$\eta = \varphi(v)y$$

$$\zeta = \varphi(v)z$$

where

$$\beta = 1/\sqrt{1 - v^2/c^2}$$

and  $\varphi(v)$  is an as yet unknown function of  $v$ .

Comment: Einstein should have presented, given the variables above:

$$\tau = a\beta^2(t - vx'/c^2)$$

$$\xi = a\beta^2(x - vt)$$

$$\eta = a\beta y$$

$$\zeta = a\beta z$$

$$\beta = 1/\sqrt{1 - v^2/c^2}$$

with  $a$  to read as  $a(v)$ . \*

The statement: "Substituting for  $x'$  its value,.." means: only in the equations  $\tau = a\{t - vx' / (c^2 - v^2)\}$  and  $\xi = ac^2x' / (c^2 - v^2)$ . The questions are which value:  $x' = x - vt$  or  $x' = ct - vt$  and in which equation? Obviously  $x' = x - vt$  has been applied in  $t - vx' / (c^2 - v^2)$ , because the result is only then  $\tau = a\beta^2(t - vx'/c^2)$ . This is contrary to what he did above when he replaced  $\tau$  in the equation  $\xi = c\tau$ , where he used  $x' = ct - vt$ .

**This is the fourth step in his manipulative mathematics.**

Having found  $\tau = a\beta^2(t - vx'/c^2)$ , one would argue that, because  $\xi = c\tau$ ,  $\xi$  simply equals  $c \cdot a\beta^2(t - vx'/c^2)$ . However Einstein presents  $\xi = \varphi(v)\beta(x - vt)$ . The question thus is: how did he create  $\xi = \varphi(v)\beta(x - vt)$ ? The first part of the answer has just been presented: he applied initially  $t = x' / (c - v)$  in  $\xi = c\tau$  in order to obtain  $\xi = ac^2x' / (c^2 - v^2)$ . This is the above mentioned "exceptional transformation on purpose". Given the definition of  $\beta$ , this  $\xi$  can be written as  $a\beta^2x'$ . The second part of the answer is that he now applied  $x' = x - vt$ , so instead of  $x' = ct - vt$ , in order to obtain  $\xi = a\beta^2(x - vt)$ .

Conclusion: Einstein only once used the exceptional definition  $x = ct$ . Outside of it he used  $x$  as  $x$ .

**Such a manipulation should be qualified as fraud, if not, then as shocking unscientific behaviour.**

The crucial question is: why did, and still does, the scientific establishment not observe such manipulations? Even worse: why did and does it make unpardonable mistakes on top of these?

\* The appendix shows that Einstein could have prevented this apparent incorrectness,  $a\beta^2$  versus  $\varphi(v)\beta$ , by simply following the mathematics as presented in this article.

## 2 Scientific establishment's unpardonable mistakes

Einstein's postulate about the speed of light sounds:

*“Any ray of light moves in the ‘stationary’ system of co-ordinates with the determined velocity  $c$ , whether the ray be emitted by a stationary or by a moving body.”*

The fundamental error in this postulate is that he effectively reintroduced, with his ‘stationary’ system, the ether model, most likely without noticing it, because he rejected the ether model himself in the same article. It is generally accepted that an absolute stationary system does not exist. As a result only a stationary system w.r.t. another system can exist. As a consequence that other system is also stationary w.r.t. the first mentioned one. Therefore the introduction of a singly ‘stationary’ system is senseless, whether it is put in quotes or not. Einstein even defined it as *the* ‘stationary’ system:

*“Let us take a system of co-ordinates in which the equations of Newtonian mechanics hold good<sup>2</sup>. In order to render our presentation more precise and to distinguish this system of co-ordinates verbally from others which will be introduced hereafter, we call it *the* ‘stationary’ system. (Note 2: i.e. to the first approximation.)”*

The scientific establishment seemingly realized this mistake too. Instead of combining this mistake with Einstein's mathematical manipulations and as a result reject the STR, it added another mistake to the story:

It changed Einstein's wrong postulate into another, even more unphysical, postulate, by assuming that the velocity of light in vacuum is  $c$  relative to whatever reference.

It is of course allowed to create whatever postulate, however it is fully unscientific to change the postulate of a particular theory fundamentally, but still maintain the result of that theory, without creating a new theory based on that new postulate.

If such an unscientific act is also more or less carried out sneakily, given the fact that there exist no reference explaining this fundamental change of Einstein's hypothesis, this very much looks like fraud.

### Conclusions

1. Einstein's mathematical errors force us to conclude that he should not be regarded as the widespread praised most intelligent scientist ever. He looks much more like a physicist who has, developing his Special Theory of Relativity, practiced physics in a shocking unscientific manner. One can hardly avoid to qualify it as fraudulent science.
2. The scientific establishment has made, about halfway the previous century, an unpardonable mistake by not exposing openly Einstein's unscientific behaviour, regarding his Special Theory of Relativity, but even worse by fundamentally altering Einstein's postulate regarding the speed light and still retaining the same result, without presenting a new theory leading to that same result. Such behaviour also looks much like fraudulent scientific behaviour.
3. The influence of Einstein's unscientific behaviour on the health of physical science is dramatic: all modern physical models and phenomena that are, more or less, based on his Special Theory of Relativity, have to be rejected too. For example: the phenomena space-time, black hole and last but not least:  $E = mc^2$ !

### References

- [1] Translated original article of Einstein:  
On the electrodynamics of moving bodies, By A. Einstein, June 30, 1905  
<http://www.fourmilab.ch/etexts/einstein/specrel/www/>
- [2] Original article of Einstein in the German language  
[http://users.physik.fu-berlin.de/~kleinert/files/1905\\_17\\_891-921.pdf](http://users.physik.fu-berlin.de/~kleinert/files/1905_17_891-921.pdf)

## Appendix

### 1. Consistency of transformation formulas

Transformation formulas 'forth':

$$\tau = \beta(t - vx/c^2) \qquad \xi = \beta(x - vt)$$

To transform back:

$$\begin{array}{lll} \text{Change on the left side of the equal sign:} & \tau \rightarrow t & \xi \rightarrow x \\ \text{Change on the right side of the equal sign:} & t \rightarrow \tau & x \rightarrow \xi \qquad v \rightarrow -v \end{array}$$

Transformation formulas 'back':

$$t = \beta(\tau + v\xi/c^2) \qquad x = \beta(\xi + v\tau)$$

Apply the  $\tau$  and  $\xi$  of the transformation formulas 'forth':

$$\begin{array}{ll} t = \beta\{\beta(t - vx/c^2) + v\beta(x - vt)/c^2\} & x = \beta\{\beta(x - vt) + v\beta(t - vx/c^2)\} \\ t = \beta^2\{t - vx/c^2 + v(x - vt)/c^2\} & x = \beta^2\{x - vt + v(t - vx/c^2)\} \\ t = \beta^2\{t - v^2t/c^2\} & x = \beta^2\{x - v^2x/c^2\} \\ t = \beta^2\{1 - v^2/c^2\} & x = \beta^2\{1 - v^2/c^2\} \\ t = \beta^2 t(c^2 - v^2)/c^2 & x = \beta^2 x(c^2 - v^2)/c^2 \end{array}$$

$$\beta^2 = 1/(1 - v^2/c^2) = c^2/(c^2 - v^2)$$

$$\text{So: } t = t \quad \text{q.e.d.} \qquad x = x \quad \text{q.e.d.}$$

### 2. The apparent incorrectness of $a\beta^2$ versus $\varphi(v)\beta$

Suppose the transformation formulas 'forth' would be taken in conformity with Einstein's **manipulative** mathematics:

$$\tau = a(v)\beta^2(t - vx/c^2) \qquad \xi = a(v)\beta^2(\xi + v\tau),$$

then the final results of the transformation formulas 'back' would be:

$$t = a(v)a(-v)\beta^4 t(c^2 - v^2)/c^2 \qquad x = a(v)a(-v)\beta^4 x(c^2 - v^2)/c^2$$

So  $a(v)a(-v)$  has to be  $\beta^2$  in order to obtain  $t = t$  and  $x = x$ .

The most obvious solution is:  $a(v)=a(-v)=\beta^{-1}$ .

In that case the original definition of  $a(v)$  in: " $\tau = a \{t - vx'/(c^2 - v^2)\}$  where  $a$  is a function  $\varphi(v)$  ....."

would lead to  $\tau = \beta^{-1} \{t - vx'/(c^2 - v^2)\}$ . For  $x' = x - vt$  the result is  $\tau = \beta(t - vx/c^2)$ .

### 3. Physics versus mathematics

These consistent transformation formulas, obtained by manipulative mathematics, might easily lead to the conclusion that the STR is a correct theory. However, doing so Einstein adapted physics to mathematics.

**Each scientist in physics has the moral responsibility to try to adapt mathematics to physics.**

## XXXI Stefan-Boltzmann constant too large by a factor $2\pi$

*Summary - As a result of a misinterpretation of Planck's mathematical presentation of the black body spectral radiation, an erroneous Stefan-Boltzmann constant has arisen. This chapter explains what that misconception is and how this factor of  $2\pi$  came about. It also shows that, as a result, the temperature of the Sun at its surface is 9146 instead of the alleged 5777 K.*

### 1 Planck's description of his black body power density spectrum

This description is found in chapter XI: Planck's theory of heat radiation criticized.

The relevant parameters are:

$h$	Planck's constant	$6.6 \cdot 10^{-34}$	J s
$c$	speed of light	$3.0 \cdot 10^8$	m/s
$k$	Boltzmann's constant	$1.4 \cdot 10^{-23}$	J/K

Planck's words:

*“Moreover the specific intensity  $K_\nu$  of a monochromatic plane polarized ray of frequency  $\nu$  is, according to equation..*

$$K_\nu = h\nu^3 c^2 / (\exp(h\nu/kT) - 1) \quad (274)”$$

*This is the specific intensity of a monochromatic plane polarized ray of the frequency  $\nu$  which is emitted from a black body at the temperature  $T$  into vacuum in a direction perpendicular to the surface.“*

Attention has to be paid to the condition: “.....emitted ..... in a direction *perpendicular* to the surface” and to the restriction “in vacuum”. The index  $\nu$  in  $K_\nu$  is from the author, not from Planck.

The characteristic property of a black body thus is that for all frequencies, from 0 to  $\infty$ , each frequency obeys the relation as shown by  $K_\nu$ . For that reason Planck uses the word ‘monochromatic’.

The dimension of  $K_\nu$  is  $W/m^2/Hz$ , thus the dimension of  $\int_0^\infty K_\nu d\nu$  is  $W/m^2$ .

The just mentioned integral plays the main role in the investigation of the subject under consideration, because in practical situations, meaning the measurement of the power density of a radiator in order to determine its temperature, all the frequencies from 0 to  $\infty$  are meant to be received simultaneously.

The related integral can be written as  $C \cdot \int_0^\infty x^3 / (e^x - 1) dx$ ,

with  $x = h\nu/kT$ , so  $\nu = xkT/h$ , thus  $d\nu = dx \cdot kT/h$ . As a result:  $C = (h/c^2) \cdot (kT/h)^4$ .

According to [1] the integral  $\int_0^\infty x^3 / (e^x - 1) dx$  is: quote “ a particular case of a Bose–Einstein integral, the poly-logarithm, or the Riemann zeta function  $\zeta(s)$ . The value of the integral is  $6 \cdot \zeta(4) = \pi^4/15$  “ end quote.

The final result is:  $\int_0^\infty h\nu^3 c^2 / (\exp(h\nu/kT) - 1) d\nu = \pi^4/15 \cdot (h/c^2) \cdot (kT/h)^4 = \pi^4/15 \cdot h^3 c^{-2} k^4 \cdot T^4 = \sigma_U T^4 W/m^2$ .

This  $\sigma_U$  thus is a factor  $2\pi$  lower than the generally accepted  $\sigma : 2\pi \cdot \pi^4/15 \cdot h^3 c^{-2} k^4 W/m^2/K^4$ .

Remark:

It has been found that  $1/(\exp(h\nu/kT)-1)$  can be simplified to  $\exp(-h\nu/kT)$  without losing much accuracy. The integral of such a spectrum is mathematically reasonable simple: 3 times in a row integrating by parts.

The outcome is:  $6 \cdot h^3 c^{-2} k^4 \cdot T^4$ , instead of  $6 \cdot \zeta(4) \cdot h^3 c^{-2} k^4 \cdot T^4$ . The value of  $\zeta(4)$  is  $\pi^4/90$ , with  $\pi^4/90 = 1.08$

The interesting question remains: what is the spectrum of the radiation of a black body in reality?



## 2 Explanation of the wrong Stefan–Boltzmann constant

Reference [1] writes:

*“The Stefan–Boltzmann law describes the power radiated from a black body in terms of its temperature.”*

Comment:

There is no Stefan–Boltzmann law, *anymore!* It has just been shown that the integration of Planck’s spectrum w.r.t. the frequency results in the expression  $\sigma T^4$ . The constant  $\sigma$  has been called the Stefan–Boltzmann constant, but why? The answer to this question is also found in [1] under “History”:

*“In 1864, John Tyndall presented measurements of the infrared emission by a platinum filament and the corresponding color of the filament. The proportionality to the fourth power of the absolute temperature was deduced by Josef Stefan in 1879 on the basis of Tyndall’s experimental measurements,.....”*

Reference [1] tells that Planck wrote his book on thermal radiation in 1913. So Planck showed his spectrum more than 20 years after Stefan experimentally discovered the relationship: power density =  $\sigma T^4$ . Besides that, Planck didn’t show the mathematically calculated integral of his spectrum:  $\pi^4/15 \cdot b^{-3} c^{-2} k^4 \cdot T^4$ . Reference [1] refers to the article of Stefan: ‘Über die Beziehung zwischen der Wärmestrahlung und der Temperatur’. It is a 40 pages long report showing a large number of measurements and calculations. In the last 4 pages the temperature of the Sun is considered. The results vary from 1700 to 10300 K, depending on the scientist carrying out the measurement. Most likely, the experiments were not performed in accordance with the conditions attached to Planck’s *later* theory, especially with regard to the emission and reception in vacuum circumstances. That might explain the enormous different results in the measured temperatures of Sun’s surface.

But still the question remains why in reference [1] a theory has been presented, adapted to the results of Stefan’s experiments, instead of accepting the inevitable theoretical result, shown in section 1. It presents a theoretical approach that lies in between Planck’s theoretical approach and a practical approach, by showing the application of Planck’s spectrum to a small flat black body. Parts of the text from [1] have been copied and presented in Italics, followed by comments.

*“The law (meant is Stefan–Boltzmann law) can be derived by considering a small flat black body surface radiating out into a half-sphere. This derivation uses spherical coordinates, with  $\theta$  as the zenith angle and  $\varphi$  as the azimuthal angle; and the small flat blackbody surface lies on the xy-plane, where  $\theta = \pi/2$ .”*

Comment:

The root of the problem is ultimately found in the words: “The law can be derived by...”, because Planck has already presented the law theoretically, and in the words “radiating out into a half-sphere”, as shown hereafter.

*“ The intensity of the light emitted from the blackbody surface is given by Planck’s law:*

$$I(\nu, T) = 2 \cdot b \nu^3 c^2 / (\exp(b\nu/kT) - 1)$$

*I( $\nu, T$ ) is the amount of power per unit surface area per unit solid angle per unit frequency emitted at a frequency  $\nu$  by a black body at temperature T.”*

Comment:

Planck’s spectrum is violated in this expression in two ways: by the addition of the factor 2 and by the addition of: “per unit solid angle”. Planck’s original text does not contain any reference to fixed angles, nor is a numerical constant used that could lead to the introduction of a factor 2.

*“ The quantity  $I(\nu, T) A d\nu d\Omega$  is the power radiated by a surface of area  $A$  through a solid angle  $d\Omega$  in the frequency range between  $\nu$  and  $\nu + d\nu$  “*

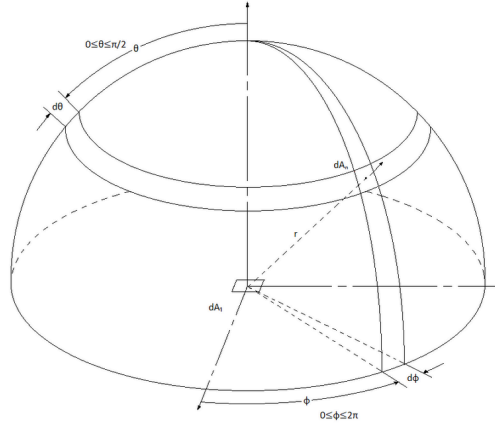
Comment:

The addition “through a solid angle  $d\Omega$ ” is fundamentally wrong, because the quantity  $I(\nu, T) A d\nu d\Omega$  has no physical meaning. The text has to be: The quantity  $I(\nu, T) A d\nu$  is the power  $P$  radiated by a surface  $A$  in a direction perpendicular to  $A$  in the frequency range  $\nu$  to  $\nu + d\nu$ . The resulting power density is  $P/A$ .

“Note that the cosine appears (in  $P/A = \int_0^\infty I(\nu, T) d\nu \int \cos\theta d\Omega$ ) because black bodies are Lambertian (i.e. they obey Lambert's cosine law), meaning that the intensity observed along the sphere will be the actual intensity times the cosine of the zenith angle. To derive the Stefan–Boltzmann law, we must integrate  $d\Omega = \sin(\theta) d\theta d\phi$  over the half-sphere and integrate  $\nu$  from 0 to  $\infty$ .”

Comment:

The figure below from [1] shows the meant flat black body A at the centre and the bottom of the drawn half-sphere. The only relevant intensity is found along the perpendicular axis on A, excluding all other possible radiations. The Lambertian character of the source, nor the half-sphere do play any role in the situation under consideration.



Remark:

At the end of 2019, criticism of [1] was published at viXra in an article which has also been sent to 7500 physicists around the world. It showed the wrong definition of the angles  $\theta$  and  $\phi$  as a minor error. Before the end of 2020 the corresponding drawing has been replaced and corrected, but the other, much more important, criticism has been ignored.

The miscalculation with the factor  $\pi$ , out of  $2\pi$ , is thus caused by a misconception of the area related to the radiation. In the example in [1], the surface  $2\pi r^2$  of a hemisphere is initially assumed as most relevant, corrected for the Lambertian character of the flat black body to  $\pi r^2$ . However, such a surface has nothing to do with a representative part of the surface of the black body.

### 3 Theory applied to Sun's radiation

In order to measure the temperature of a black body based on its radiation, a representative area  $S$  of that source must be observed perpendicularly through the beam of a measuring device, in vacuum, preferably as close as possible to the black body. The power  $P_r$  thus received has to be divided by that area  $S$ . Only in such a configuration is it allowed to use the relationship  $P_r/S = \sigma_U T^4$  to calculate the temperature.

To measure Sun's temperature at its surface the position has to be far a way from the Sun and at the same time far outside earth's atmosphere. So-called extraterrestrial radiation measurements. The average power density measured over the past decades is  $1367 \text{ W/m}^2$ . The distance  $r_d$  to the Sun is  $1.5 \cdot 10^{11} \text{ m}$ , so Sun's power is  $1367 \cdot 4\pi r_d^2 \text{ W}$ . The radius  $r_s$  of the Sun is  $7 \cdot 10^8 \text{ m}$ , so the power density at its surface is  $1367 \cdot 4\pi r_d^2 / 4\pi r_s^2 = 6.3 \cdot 10^7 \text{ W/m}^2$ . This makes the temperature there  $(6.3 \cdot 10^7 / \sigma_U)^{1/4} = 9164 \text{ K}$ .

### Conclusions

- 1 The Stefan-Boltzmann constant  $\sigma = 2\pi \cdot \pi^4 k^4 / 15 h^3 c^2 \text{ (W/m}^2/\text{K}^4)$  has to be replaced by  $\sigma_U = \sigma / 2\pi$ .
- 2 One of the consequences of the application of the too large Stefan-Boltzmann constant is that the temperature of Sun's surface is 9146, instead of the alleged 5777 K.

### Reference

- [1] [https://en.wikipedia.org/wiki/Stefan-Boltzmann\\_law](https://en.wikipedia.org/wiki/Stefan-Boltzmann_law)

## XXXII Planck's spectrum as function of wavelength is untenable

*Summary - Scrutinizing Planck's spectra as function of frequency and as function of wavelength learns that the last mentioned one leads to baffling results.*

### 1 Introduction

Planck's book about this subject, originally written in 1913, has been translated to English as shown in [1]. He presents two types of spectra for the so-called black body radiation, one as function of frequency, the other one as function of wavelength. The second one turns out to be untenable.

### 2 The black body radiation spectrum as function of frequency and wavelength

Planck presented the following two spectra, supplemented with his commentary in Italics:

$$K_\nu = h\nu^3 c^2 / (\exp(h\nu/kT) - 1) \quad \text{W/m}^2/\text{Hz}$$

*"This is the specific intensity of a monochromatic plane polarized ray of the frequency  $\nu$  which is emitted from a black body at the temperature  $T$  into vacuum in a direction perpendicular to the surface."*

$$E_\lambda = (hc^2 \lambda^{-5}) / (\exp(hc/k\lambda T) - 1) \quad \text{W/m}^2/\text{m}$$

*"This is the specific intensity of a monochromatic ray not to the frequency  $\nu$  but, as is usually done in experimental physics, to the wavelength  $\lambda$ ..."*

The spectrum  $E_\lambda$  is incorrect for the following 3 reasons:

- 1 the maximum of  $E_\lambda$  is not at the same frequency as of  $K_\nu$
- 2  $K_\nu$  and  $E_\lambda$  show an incomprehensible relationship
- 3 the dimension of  $E_\lambda$  is meaningless/unphysical

ad 1 The maximum of  $K_\nu$  is found for  $dK_\nu/d\nu = 3\nu^2 \cdot (e^{a\nu} - 1)^{-1} - \nu^3 \cdot (e^{a\nu} - 1)^{-2} \cdot e^{a\nu} \cdot a = 3 - a\nu / (1 - e^{-a\nu}) = 0$

Approximating $1 - e^{-a\nu}$	by	$a\nu - a^2\nu^2/2$	leads to $\nu = (4/3) \cdot a^{-1} = (4/3)kT/b$	Hz
Approximating $1 - e^{-a\nu}$	by	$a\nu - a^2\nu^2/2 + a^3\nu^3/6$	leads to $\nu = 4 \cdot a^{-1} = 4kT/b$	Hz
Approximating $(e^{a\nu} - 1)^{-1}$	by	$e^{-a\nu}$ directly in $K_\nu$	leads to $\nu = 3 \cdot a^{-1} = 3kT/b$	Hz

The numerical calculation of  $K_\nu$  shows that the latter approximation is accurately close to reality.

This approximation applied to  $E_\lambda$  and replacing  $1/\lambda$  by  $y$ , leads to  $E_y = hc^2 y^5 \cdot e^{-by}$ , with  $b = hc/kT$ .

$dE_y/dy = 5y^4 \cdot e^{-by} + y^5 \cdot (-b) \cdot e^{-by} = 5 - y \cdot b = 0$ , so the maximum of  $E_\lambda$  is found at  $\nu = 5kT/b$ .

ad 2 The cause of the deviation from  $\nu = 3kT/b$  in  $K_\nu$  is *only* the power 5 of  $1/\lambda$  in  $E_\lambda$ .

Writing blindly  $hc^2/\lambda^3$  instead of  $hc^2/\lambda^5$  would lead to the dimension  $\text{W/m}$  instead of  $\text{W/m}^2/\text{m}$  of  $E_\lambda$ .

The solution to this problem should be found in the introduction of a *constant* with dimension  $\text{m}^{-2}$ , instead of the introduction, as Planck did, of  $\lambda^{-2}$ . However such a constant does not exist. In order to show the mutual incomprehensible relationship between  $K_\nu$  and  $E_\lambda$  their maximum values are compared.

Applying  $\nu = 3kT/b$  in  $K_\nu$  results in  $K_{\nu\text{max}} = 9.5 \cdot 10^{-20} \cdot T^3 \quad \text{W/m}^2/\text{Hz}$

Applying  $\nu = 5kT/b$  in  $E_\lambda$  results in  $E_{\lambda\text{max}} = 2.0 \cdot 10^{-6} \cdot T^5 \quad \text{W/m}^2/\text{m}$

These results show the already mentioned weird relationship, as well as the fact that  $E_\lambda$  has to be rejected.

Ad3 The correct expression for  $E_\lambda$  is found when  $\nu^3$  in  $K_\nu$  is replaced by  $c^3/\lambda^3$  and  $E_\lambda$  is written as  $E_\nu$ :

$$E_\nu = (hc/\lambda^3) / (\exp(hc/k\lambda T) - 1) \quad \text{W/m}^2/\text{Hz}$$

The index  $\nu$  is chosen to emphasize that the integration of this spectrum has to be done w.r.t. the frequency. In a numerical situation, where  $\lambda$  is taken as the primary variable,  $\Delta\lambda$  (being  $\lambda_n - \lambda_{n-1}$ ) has to be replaced by  $\Delta\nu$  as  $c/\lambda_{n-1} - c/\lambda_n$ .

### 3 The most likely cause of the incorrect spectrum $E_\lambda$

This cause can be found by using the simplified shape, in order to show what happens with the integration of the spectrum as proposed by Planck. Replacing  $\lambda^{-1}$  by  $y$  results in the following equations:

$$\int E_\lambda d\lambda = hc^2 \int \lambda^{-5} e^{-bc/\lambda T} d\lambda \quad \text{becomes} \quad \int E_y dy = hc^2 \int f(y) \cdot y^5 e^{-by} d(y^{-1}) \quad \text{with } b=bc/kT$$

$$dy^{-1}/dy = -y^{-2}, \text{ so } dy^{-1} = -y^{-2}dy, \text{ so } f(y) = -y^{-2}, \text{ resulting in: } \int E_y dy = -hc^2 \int y^3 e^{-by} dy$$

Three times in a row integrating by parts delivers  $\int_0^\infty E_y dy = hc^2 \cdot 6 \cdot b^{-4} = 6 \cdot h^{-3} c^2 k^4 \cdot T^4$ , being equal to the integration of the simplified spectrum of  $K_\nu$ , implicitly as function of the frequency.

That implies that, notwithstanding the fact that  $E_\lambda$  as power density *spectrum* is fundamentally wrong, its power density is correct, when integrated w.r.t. the wavelength.

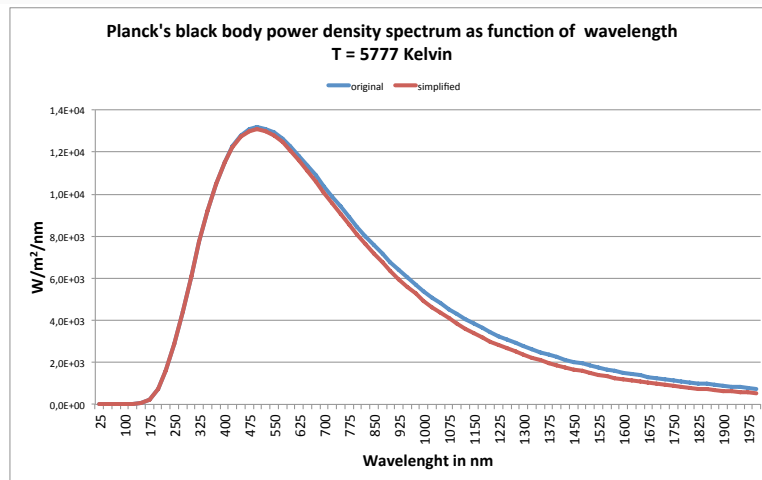
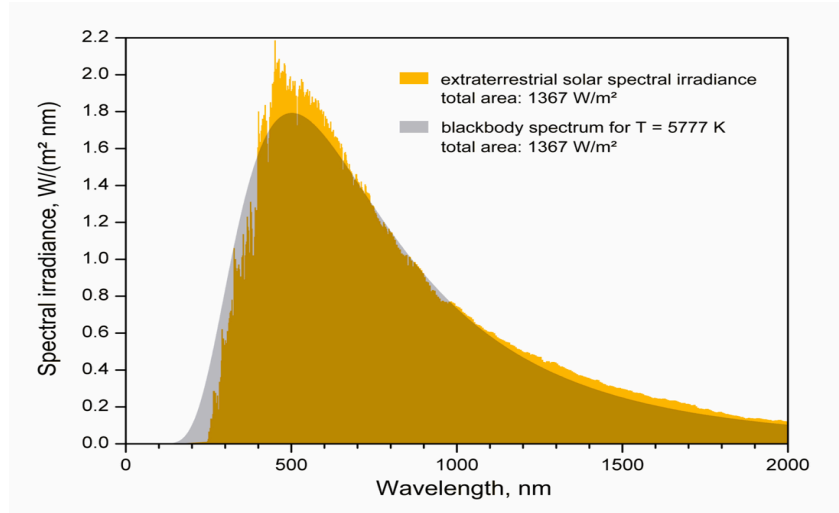
As shown in section 1 the maximum value of  $E_\lambda$  as well its position, expressed in either frequency or wavelength, is wrong. For example at  $T = 5777$  K in the simplified spectra:

$$E_{\lambda_{\max}} = 2.0 \cdot 10^{-6} \cdot T^5 = 1.3 \cdot 10^4 \text{ W/m}^2/\text{nm}, \text{ at } \lambda \sim c/(5kT/b) \sim 500 \text{ nm}, \text{ at } \nu \sim 5kT/b \sim 600 \text{ THz}$$

$$K_{\nu_{\max}} = 9.5 \cdot 10^{-20} \cdot T^3 = 1.8 \cdot 10^{-8} \text{ W/m}^2/\text{Hz}, \text{ at } \lambda \sim c/(3kT/b) \sim 900 \text{ nm}, \text{ at } \nu \sim 3kT/b \sim 360 \text{ THz}$$

The numerically calculated values for the original spectrum are:  $\lambda_{\max} = 879$  nm, resp.  $\nu_{\max} = 341$  THz.

The ratio  $1.8 \cdot 10^{-8} \text{ Wm}^{-2}\text{Hz}^{-1} / 1.3 \cdot 10^4 \text{ Wm}^{-2}\text{nm}^{-1} = 1.4 \cdot 10^{-12} \text{ nm/Hz}$  doesn't show a meaningful outcome, due to the dimension, as well as the numerical outcome. But still the curves are used, as shown below.

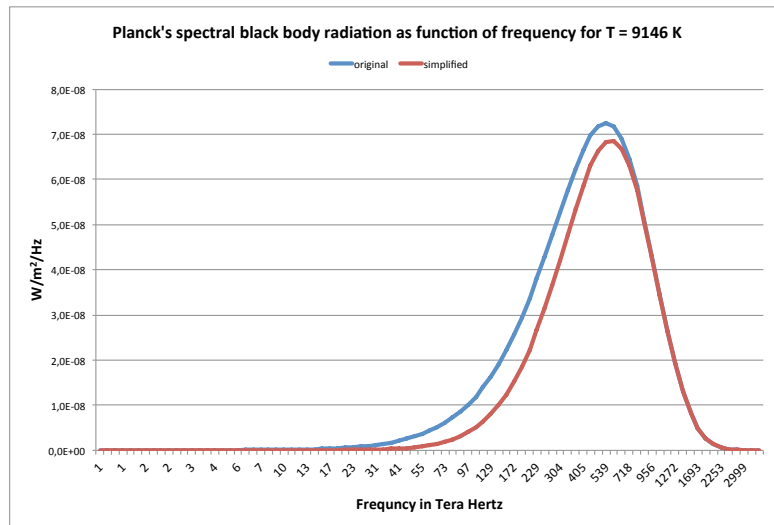


Mind the presented maximum value in the upper graph: 1.8, instead of  $1.3 \cdot 10^4 \text{ W/m}^2/\text{nm}$ !

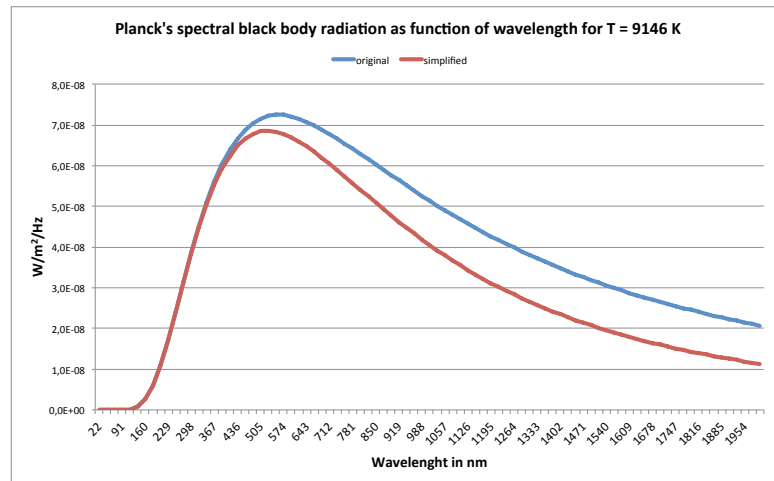
Is it coincidental that the number 1.8 shows up too in  $K_{\nu_{\max}}$  as  $1.8 \cdot 10^{-8} \text{ Wm}^{-2}/\text{Hz}$ ?

See chapter XXXI for the interpretation of the extraterrestrial solar spectral radiation.

The surprising accuracy of the position of the maximum value in the simplified spectrum has been the motivation to draw the graphs of  $K_v$  and  $E_v$  for both Planck's original and the simplified spectra.



Graph of  $K_v$



Graph of  $E_v$

#### 4 Wien's displacement law

Wien's displacement law sounds, copied from [2]:

“The spectral radiance of black-body radiation per unit wavelength, peaks at the wavelength  $\lambda_{\text{peak}}$  given by:  $\lambda_{\text{peak}} = b/T$ , where  $T$  is the absolute temperature and  $b$  the constant  $2898 \mu\text{m}\cdot\text{K}$ .”

In section 3 it has been proven mathematically that, applying the correct spectrum expressed in  $\text{W}/\text{m}^2/\text{Hz}$  the maximum value of such spectrum is found at  $\lambda \sim c/(3kT/h) = (hc/3k)/T$ , versus the application of the incorrect spectrum:  $\lambda \sim (hc/5k)/T$ , with  $(hc/5k) = 2878 \mu\text{m}\cdot\text{K}$ , more accurately:  $(hc/4.984k) = 2887 \mu\text{m}\cdot\text{K}$ . So Wien also had the problem of using, unconsciously, the incorrect spectrum.

#### Conclusion

The originally by Planck proposed spectrum as function of wavelength has to be rejected and replaced by his spectrum as function of frequency in which the variable  $\nu$  simply is replaced by  $c/\lambda$ .

#### References

- [1] Planck M. The theory of heat radiation. P. Blakiston's Son & Co., Philadelphia, PA, 1914, free available at: <http://www.gutenberg.org/zipcat2.php/40030/40030-pdf.pdf>
- [2] [https://en.wikipedia.org/wiki/Wien's\\_displacement\\_law](https://en.wikipedia.org/wiki/Wien's_displacement_law)

### XXXIII Experimental evidence of $E \neq mc^2$

*Summary - Presented measured energies of charged particles in space, so-called cosmic rays, prove themselves that the expression  $E = mc^2$  is untenable.*

#### 1 Introduction

The definition of cosmic rays as found on Wikipedia sounds: “Cosmic rays are high-energy protons and atomic nuclei which move through space at nearly the speed of light.”

In this article a closer investigation is shown concentrated on just protons.

#### 2 The concept “nearly the speed of light”

The importance of this concept is found in the expression  $E = mc^2$ , in which the mass  $m$  is considered to be dependant on its velocity  $v$  in accordance to the alleged function

$$m = m_{\text{rest}} / \sqrt{(1-v^2/c^2)}, \text{ shortly expressed as } m = \gamma m_{\text{rest}}$$

Because only velocities of nearly the speed of light will be considered,  $v$  will be presented as

$$v = c - \epsilon_v, \text{ with } \epsilon_v \ll c$$

Given:  $1-v^2/c^2 = c^2(c^2-v^2) = c^2(c-v) \cdot (c+v) \approx c^2 \cdot \epsilon_v \cdot 2c = 2\epsilon_v c$ , the expression for  $m$  can be approximated sufficient accurately, regarding the purpose of this article, by

$$m \approx m_{\text{rest}} \cdot \sqrt{c/2\epsilon_v}$$

The alleged energy of such a mass is  $E(\text{J}) = m_{\text{rest}} \cdot \sqrt{c/2\epsilon_v} c^2$  (Joule) =  $6.25 \cdot 10^{18} \cdot E(\text{J})$  (eV).

Table I shows a few examples for  $m_{\text{rest}} = 1.7 \times 10^{-27}$  kg, the mass of a proton. These examples are based on the text written in reference [1]:

*“Cosmic rays attract great interest practically, ..... and scientifically, because the energies of the most energetic ultra-high-energy cosmic rays have been observed to approach  $3 \times 10^{20}$  eV, about 40 million times the energy of particles accelerated by the Large Hadron Collider ( $7.5 \cdot 10^{12}$  eV).*

*One can show that such enormous energies might be achieved by means of the centrifugal mechanism of acceleration in active galactic nuclei. At 50 J, the highest-energy ultra-high-energy cosmic rays (such as the Oh-My-God particle recorded in 1991)..... “*

v (m/s)	$\gamma$	Joule	eV	specification
0	1	$1.5 \cdot 10^{-10}$	$9.6 \cdot 10^8$	
$c/3$	1.06	$1.6 \cdot 10^{-10}$	$1.0 \cdot 10^9$	
$2c/3$	1.34	$2.1 \cdot 10^{-10}$	$1.3 \cdot 10^9$	
$c - 135$	1000	$1.6 \cdot 10^{-7}$	$1.0 \cdot 10^{12}$	CERN
$c - 2.4$	7872	$1.2 \cdot 10^{-6}$	$7.5 \cdot 10^{12}$	LHC
$c - 1.4 \cdot 10^{-15}$	$3.3 \cdot 10^{11}$	50	$3.1 \cdot 10^{20}$	Oh-My-God

Table I Examples of theoretical energies of cosmic rays

In the next section the distance  $d_b$  of the protons to earth, where the gravitational forces of galaxy and earth are in equilibrium, plays a significant role. This distance is  $\sqrt{M_e/M_g}$  ‘total distance’.

With  $M_g = 8 \cdot 10^{31}$  kg,  $M_e = 6 \cdot 10^{24}$  kg and ‘total distance’ =  $2.4 \cdot 10^{20}$  m,  $d_b$  is about  $2 \cdot 10^{14}$  m.

### 3 Three fundamental problems of $E = mc^2$

#### 3.1 Relativistic kinetic energy and potential energy

The backgrounds of these concepts are in detail considered in the appendix, with the following results:

- The potential energy of a mass  $m$  at distance  $d$  from earth equals  $GM_e m(1/r_e - 1/d)$ , with  $r_e$  earth's radius,  $M_e$  its mass and  $G$  the gravitational constant. For  $d = d_b$  the result is  $GM_e m/r_e$ .
- According to the Newtonian laws, "releasing"  $m$  at distance  $d_b$  causes instantaneously kinetic energy. Having arrived at earth, this energy ( $\frac{1}{2}mv_{re}^2$ ) must equal  $GM_e m/r_e$ . So  $v_{re} = \sqrt{2GM_e/r_e}$ , being the so-called escape velocity: Quote: ".....escape velocity is the minimum speed needed for a free, non-propelled object to ..... achieve an infinite distance from it." Newtonian laws prescribe the addition of  $v_{re}$  to the speed  $v_i$  of  $m$  at  $d_b$ , resulting in  $v_{eN} = v_i + v_{re}$ .
- Following the rules of the theory of relativity the increase of kinetic energy on the same trajectory is  $\Delta K = (\gamma_{re\Delta K} - \gamma_i)m_{rest}c^2$ , with  $\gamma_{re}$  the multiplication factor for  $m_{rest}$  at  $r_e$  and  $\gamma_i$  at  $d = d_b$ . The end velocity  $v_{eR}$  has been deduced in order to compare it with the just shown Newtonian.  $v_{eR} = \sqrt{\{c^2 - (c^2 - v_i^2)/(GM_e/r_e c^2 + 1)^2\}} \sim \sqrt{\{(2GM_e/r_e)^2 + v_i^2\}}$ . See the appendix for the derivation.
- The few examples below show that the more  $v_i$  approaches  $c$ , the more the influence of the potential energy on the protons is reduced. Seen from a physical point of view unacceptable.  $c$  has been chosen exactly  $3 \cdot 10^8$  m/s and  $r_e$  as 6400 km, so the escape velocity is 11200 m/s. The table shows also that for  $v_i$  is the escape velocity,  $v_{eR}$  indeed is accurately  $\sqrt{2} \cdot v_i$ .

$v_i$	$v_{eR}$	$v_{eR} - v_i$
0	11200	11200
11200	15839	4639
100000	100625	625
10000000	10000006	6
299999900	299999900	0

#### 3.2 The violation of the axiom\* of conservation of mass

The theory of relativity does not and can not explain how the extreme increase of the mass of the cosmic particle, as function of its velocity, is realised in order to fulfil the axiom of conservation of mass.

\* An axiom is a presumption of which its validity is strongly self-evident.

#### 3.3 The violation of the axiom of conservation of energy

The theory of relativity does not and can not explain how the extreme increase of the energy of the cosmic particle, as function of its velocity, is realised in order to fulfil the axiom of conservation of energy.

### Conclusions

- 1 The measured extremely high energy of the "Oh-my-God particles" in cosmic rays explicitly implies that, according to the expression  $E=mc^2$  as well as to the expression of the relativistic kinetic energy, the existence of potential energy of such particles with respect to earth is completely ignored.
- 2 The second fundamental problem is that the interpretation of the measurements implies the violation of the axiom of conservation of mass.
- 3 The third fundamental problem is that the interpretation of the measurements implies the violation of the axiom of conservation of energy.
- 4 The moral question thus is: why would a sincere physicist defend  $E = mc^2$  as a realistic physical concept?

### References

- [1] [https://en.wikipedia.org/wiki/Cosmic\\_ray](https://en.wikipedia.org/wiki/Cosmic_ray)
- [2] <http://www.phys.ufl.edu/~acosta/phy2061/lectures/Relativity4.pdf>

## Appendix of XXXIII Newtonian and relativistic kinetic energy

### Newtonian potential and kinetic energy

The Newtonian *potential* energy of an object with mass  $m$  at distance  $d$  from *the centre of earth* with mass  $M_e$  can be calculated by applying the law:  $W(\text{ork}) = \int F(s).ds$ , with  $F(s) = GM_e m/s^2$ . The lower boundary of the integral is radius  $r_e$  of earth and the upper one is  $d$ . The outcome is:  $E_p = GM_e m(1/r_e - 1/d)$ . See VII.

$E_p$  must be positive, because it needs energy to transport  $m$  from  $r_e$  to  $d$ . In the reverse direction starting at  $d$ , with  $m$  at rest relative to earth, this energy will be released and instantaneously transformed into kinetic energy. At distance  $r_e$ , from the centre of earth, the kinetic energy of  $m$  must be equal to  $E_p$ , so

$$\frac{1}{2}mv_{re}^2 = GM_e m(1/r_e - 1/d)$$

An extreme situation is  $d \rightarrow \infty$ , leading to  $\frac{1}{2}mv_{re}^2 = GM_e m/r_e$ . The resulting velocity  $v_{re} = \sqrt{2GM_e/r_e}$  equals to so called escape velocity, in this case of earth.  $v_{re} = 11200$  m/s, as rounded value.

So the Newtonian kinetic energy of an object with mass  $m$ , starting its “fall” at very large distance, w.r.t. the radius of earth, arriving at earth is  $\frac{1}{2}mv_{re}^2 = GM_e m/r_e$ .

If this process is started with a constant velocity  $v_i$  at position  $d$ , then the additional velocity, as a result of the potential energy, is simply added to  $v_i$ . At the end of the trajectory the velocity is  $v_{eN} = v_i + v_{re}$ .

### Relativistic potential and kinetic energy

The relativistic potential energy is equal to the Newtonian one, because there is no velocity involved. The transformation of potential energy to relativistic kinetic energy (K) can be carried out as follows.

The force in the expression of “Work” is now written as  $F=ma$ , with  $a=dv/dt$ , and  $ds$  (in  $F(s).ds$ ) written as  $vdt$ , resulting in  $m_{rest}dv/dt \gamma vdt = m_{rest}vd(\gamma v)$ . Integrating by parts gives:  $K = \gamma m_{rest}v^2 \Big|_{0^v} - m_{rest} \int_{0^v} \gamma v dv$ . The integral  $\int_{0^v} \gamma v dv$  turns out to be  $-\frac{c^2}{\gamma} \Big|_{0^v} = -\frac{c^2}{\gamma} + c^2$ .

So  $K = m_{rest} \{ \gamma v^2 + \frac{c^2}{\gamma} - c^2 \} = \gamma m_{rest}(v^2 + \frac{c^2}{\gamma^2}) - m_{rest}c^2 = \gamma m_{rest}c^2 - m_{rest}c^2 = (\gamma - 1)m_{rest}c^2$ .

This solution eliminates the ambiguity between classic kinetic energy for  $v = 0$ , because  $K = 0$  for  $v = 0$ . But  $E = mc^2$  is still  $m_{rest}c^2$  for  $v = 0$ . This problem has been “solved” *semantically* by stating, in reference [2], that  $E = \gamma m_{rest}c^2 = K + m_{rest}c^2$ , defining  $m_{rest}c^2$  as *potential* energy and  $E$  as *total* energy!

*Static* energy would have been a more appropriate definition for  $m_{rest}c^2$ .

In order to compare the Newtonian transformation, of potential energy into kinetic energy with the relativistic transformation, the relativistic velocity  $v_{eR} = v_i + v_{re}$ , will be calculated in such a situation.

If the initial velocity is  $v_i$  the increase of the relativistic kinetic energy is  $(\gamma_e - \gamma_i) m_{rest}c^2$ , with  $\gamma_e = 1/\sqrt{1-v_{eR}^2/c^2}$  and  $\gamma_i = 1/\sqrt{1-v_i^2/c^2}$ , and a potential energy at position  $d \gg r_e$  equal to  $GM_e \gamma_i m_{rest}/r_e$ .

Fulfilling the law that potential energy is transformed into kinetic energy:

it follows from  $(\gamma_e - \gamma_i) m_{rest}c^2 = GM_e \gamma_i m_{rest}/r_e$  that  $(\gamma_e - \gamma_i) c^2 = \gamma_i GM_e / r_e$

to be written as  $\gamma_e = \gamma_i (GM_e/r_e c^2 + 1) = \gamma_i (G_c + 1)$  with  $G_c = GM_e/r_e c^2 \ll 1$

applying  $\gamma_e = 1/\sqrt{1-v_{eR}^2/c^2}$  it follows that  $v_{eR} = c\sqrt{1 - 1/\gamma_e^2}$

applying  $\gamma_e = \gamma_i (G_c + 1)$  it follows that  $v_{eR} = c\sqrt{1 - 1/\gamma_i^2(G_c + 1)^2}$

applying  $\gamma_i = 1/\sqrt{1-v_i^2/c^2}$  it follows that  $v_{eR} = \sqrt{c^2 - (c^2 - v_i^2)/(G_c + 1)^2}$

Because  $G_c \ll 1$  an accurate approximation of  $v_{eR}^2$  is  $(2GM_e/r_e)^2 + v_i^2 = v_{escape}^2 + v_i^2$ , showing that for  $v_i=0$ , the end velocity  $v_{eR}$  equals, just like in the Newtonian situation, the escape velocity of earth.

For  $v_i = c$  the velocity  $v_{eR}$  also equals  $c$ , because  $v_i \gg v_{escape}$ , completely ignoring the influence of the potential energy of the proton relative to earth. Values of  $v_i$  in between these two extreme situations eliminate the potential energy fluently more, the more  $v_i$  increases, as shown in the main article.



## XXXIV The photoelectric effect

*Summary - Given the evidence that a photon is a short period of an electromagnetic wave with a well defined amount of energy, the theory how light can cause an electron to escape from a metal can easily be shown to be the reverse process.*

### 1 Introduction

The photoelectric effect is the physical process of the transformation of light to electric current.

“Light” to read as: an electromagnetic wave of a certain frequency (Hz), with a certain power density ( $\text{W}/\text{m}^2$ ) and of a certain length, expressed in time (s), shortly: a photon.

“Electric current” to read as: the electrons that got escaped from a (cathode’s) surface (due to the collision/entering of a photon with an atom at that surface) and accelerated in the direction of the anode as a result of the applied voltage between cathode and anode.

### 2 Theoretical approach in modern physics

Reference [1] presents the following text:

*“In 1905, Einstein proposed a theory of the photoelectric effect using a concept first put forward by Max Planck that light consists of tiny packets of energy known as photons or light quanta. Each packet carries energy  $h\nu$  that is proportional to the frequency  $\nu$  of the corresponding electromagnetic wave. The proportionality constant  $h$  has become known as the Planck constant. The maximum kinetic energy  $K_{\text{max}}$  of the electrons that were delivered this much energy before being removed from their atomic binding is  $K_{\text{max}} = h\nu - W$ , where  $W$  is the minimum energy required to remove an electron from the surface of the material. It is called the work function of the surface and is sometimes denoted  $\Phi$  or  $\phi$ . If the work function is written as  $W = h\nu_0$  the formula for the maximum kinetic energy of the ejected electrons becomes  $K_{\text{max}} = h(\nu - \nu_0)$ .”*

Comment:

In the next section it will be shown that, if the relation  $K_{\text{max}} = h(\nu - \nu_0)$  would be correct the so called “Cathode radiant sensitivity” in figure 3 in that section would be a straight line, decreasing with increasing wave length/decreasing frequency. That figure thus shows that Einstein’s relation is incorrect.

Besides that, it has been pointed out in chapter VIII that the relation  $E = h\nu$  is only valid in the situations where the Rydberg expression is satisfied.

### 3 Theoretical background based on the theory that a photon is not a particle

#### 3.1 The generation of a photon

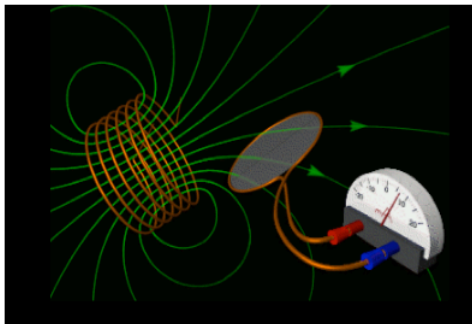
As described in chapter VIII the *generation* of a photon is based on the following theory:

- 1 An orbiting electron is equivalent to a circular shaped electric current, creating a magnetic field through the plane of the orbit.
- 2 When the electron jumps out of its orbit, to whatever *outer* orbit or out of the atom, the strength of this magnetic field changes, creating an electric field.
- 3 A source of an electromagnetic wave has emerged, emitting a so-called photon.
- 4 When the new atom configuration has been stabilized, this source stops the emission.

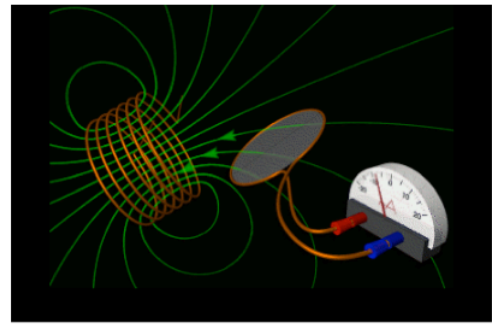
### 3.2 The photoelectric effect

It is hypothesized that the photoelectric effect is basically configured by the reverse process of the generation of a photon.

- 1 An external magnetic field, entering the plane of an orbiting electron, causes that electron to increase / decrease its velocity, depending on the direction of that external magnetic field in relation to the direction of the internal magnetic field, perfectly supported by an animation movie, copied from reference [1], and shown in figure 1 and 2. The single winding has to be interpreted as the orbit of the electron. The changing magnetic field of the coil as the magnetic part of the electromagnetic field of the entering photon.



*Figure 1*



*Figure 2*

- 2 An in- resp. decreasing velocity of an orbiting electron results in an escape from the existing orbit towards an outer resp. inner orbit.
- 3 Several situations are now possible, of which the most extreme one is the escape of the electron out of the atom as a free electron.
- 4 In all other situations the electron only changes its orbit. In case the electron jumps to an outer orbit a new photon will be emitted, most likely of a different frequency than the one of the incoming photon.
- 5 If an electron jumps to an inner orbit, the intrinsic energy of the atom will increase and manifest itself as an increased temperature of the material to which the atom belongs. See chapter XXVI: “How electromagnetic radiation raises temperature”.

## 4 Experimental evidence

Like the frequency of emitted photons from a certain material is restricted to a certain range, so is the sensitivity of a certain material restricted to a certain range of frequencies regarding the transformation of light into free electrons. See figure 3 belonging to phototubes with different kinds of cathode material. The figure has been copied from reference [2].

The text underneath the figure in this reference sounds: “Cathode radiant sensitivity”.

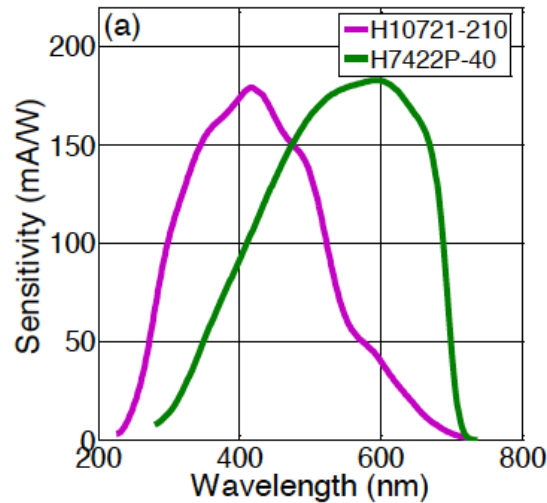


Figure 3

The figure clearly shows that:

the frequency of the incoming light has to be tuned to the receiving material

Einstein's expression  $K_{\max} = h(\nu - \nu_0)$  or  $V_0 = (h/e) (\nu - \nu_0)$  has to be rejected.

## Conclusion

Given the fact that an atom from which an electron escapes, generates a photon as a short period of an electromagnetic wave with a well defined amount of energy, such a photon is reversely able to let an electron escape from an atom, so from a cathode to which the atom belongs, in order to create an electric current in the direction of the anode.

Consequently a photon will be emitted too, most likely of a different frequency than of the incoming one.

## References

- [1] [https://en.wikipedia.org/wiki/Photoelectric\\_effect](https://en.wikipedia.org/wiki/Photoelectric_effect)
- [2] Google for: “Tunable, Ultrafast Fiber-Laser between 1.15  $\mu\text{m}$  and 1.35  $\mu\text{m}$  “

## XXXV Recipe for calculating nuclear energy in modern physics

*Summary – A few years ago about five nuclear physicists were asked for such a recipe. No one answered the question. But what is under increasing pressure will eventually burst open. A science historian recently informed me of this recipe. Closer examination of it shows that Einstein indeed ruined physics by introducing his theories of relativity.*

### 1 Introduction

The following property of  $E = mc^2$  is generally accepted, often even adored, by physicists:

$E = mc^2$  is the equation meant to express that mass and energy are the same physical entity and can be changed into each other.

Einstein closes his Special Theory of Relativity with the expression:  $W = mc^2\{1/\sqrt{(1-v^2/c^2)} - 1\}$ , shown in reference [1] at page 22. The text prior to this formula reads:

“If an electron moves from rest at the origin of co-ordinates of the system K along the axis of X under the action of an electrostatic force X, it is clear that the energy withdrawn from the electrostatic field has the value  $W = \int \epsilon X dx$ ”

N.B. The same symbol X is used for mutually fundamentally different variables!

He refers as follows to this outcome in his book: RELATIVITY The Special and General Theory, reference [2], page 53:

“In accordance with the theory of relativity the kinetic energy of a material point of mass  $m$  is no longer given by the well-known expression  $\frac{1}{2}mv^2$ , but by the expression  $mc^2/\sqrt{(1-v^2/c^2)}$ .”

After having presented the series of this expression he continues with:

“The first term  $mc^2$  does not contain the velocity, and requires no consideration if we are dealing with the question as to how the energy of a point-mass depends on the velocity.”

At page 55 is found:

“A body moving with the velocity, which absorbs<sup>1</sup> an amount of energy  $E_0$  in the form of radiation without suffering an alteration in velocity in the process, has, as a consequence, its energy increased by an amount  $E_0/\sqrt{(1-v^2/c^2)}$ .”

<sup>1</sup> “ $E_0$  is the energy taken up, as judged from a co-ordinate system moving with the body.”

At page 56 Einstein states:

“Writing the expression for the energy in the form  $(mc^2 + E_0)/\sqrt{(1-v^2/c^2)}$ , we see that the term  $mc^2$ , which hitherto attracted our attention, is nothing else than the energy possessed by the body<sup>1</sup> before it absorbed the energy  $E_0$ .”

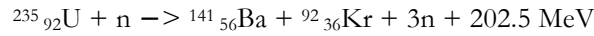
<sup>1</sup> Similar to<sup>1</sup> on page 55: “As judged from a co-ordinate system moving with the body.”

In the context of the problem to be considered here, note<sup>1</sup> casts doubt on his theory in advance, because what would be the outcome if that judgement is *not* carried out “from a co-ordinate system moving with the body”, as is usually the case in experiments?

Anyway, the final result is Einstein’s statement that “a material point of mass  $m$  “ has (intrinsically) an energy  $E = mc^2$ . When it gets moving with velocity  $v$  the kinetic energy  $\frac{1}{2}mv^2$  has to be added to it. Einstein most likely didn’t realize himself that  $E = mc^2$  implies that, whatever (kind of) mass is chosen, its energy density  $E/m$ , in terms of J/kg, is  $c^2$ . A fully unrealistic high value, for any “material point of mass“!

## 2 The recipe

The easiest way to show and explain the recipe is to take an example. In this case a  $^{235}_{92}\text{U}$  Uranium atom that is bombarded by 1 neutron and split as shown in reference [3]:



The recipe is that the amu's of all elements in the left resp. right side of the displayed expression, are summed. The difference between these totals, called "mass defect", is used in  $E = m_{\Delta}c^2$  in order to calculate the released energy.

The amu's, found by separately searching for the amu of the element on Internet, are:

$^{235}\text{U}$ : 235.0439                       $^{141}\text{Ba}$ : 140.9144                       $^{92}\text{Kr}$ : 91.9262                      n: 1.0087

Applied in the example:	total left side	235.044 amu
	total right side	$140.914 + 91.926 + (3-1) * 1.0087 = 234.857$ amu
	difference	+0.187 amu
	difference in kg (1 amu = $1.66 \cdot 10^{-27}$ kg [4]):	$3.1 \cdot 10^{-28}$ kg
	$E = m_{\Delta}c^2$	$2.79 \cdot 10^{-11}$ Joule = 174 MeV

The difference from 202.5 MeV is explained as follows in [3]:

"Instantaneously released energy		
	Kinetic energy of fission fragments	169.1
	Kinetic energy of prompt neutrons *	4.8
	Energy carried by prompt $\gamma$ -rays	7.0
Energy from decaying fission products		
	Energy of $\beta^-$ -particles	6.5
	Energy of delayed $\gamma$ -rays	6.3
	Energy released when those prompt neutrons, which don't (re)produce fission, are captured	8.8
Total energy converted into heat in an operating thermal nuclear reactor		202.5"

The sum of the first 2 mentioned kinds of energy are in perfect accordance with 174 MeV. So seemingly only kinetic energy is assumed to be generated out of mass defect.

\* [3]: "In nuclear engineering, a prompt neutron is a neutron immediately emitted by a nuclear fission event, ....."

## 3 Objections to the recipe

Copied from chapter XX:

Ultimately the foundation of the amu is a combination of the neutron, proton and electron mass:

$$m_N = 1.674927471 \cdot 10^{-27} \quad m_P = 1.672621898 \cdot 10^{-27} \quad m_e = 9.10938356 \cdot 10^{-31} \quad \text{kg}$$

All these masses are claimed to have a *relative* uncertainty of  $10^{-10}$ !

Presented in [4]:

"Amu is defined as one twelfth of the mass of an *unbound* neutral atom of carbon-12 in its nuclear and electronic ground state and at rest, and has a value of  $1.66053906660(50) \cdot 10^{-27}$  kg."

The mass of these particles is defined in the so-called unbound state, meaning: not bound to other elements / particles. For example: an unbound atom is an atom not *chemically* bound to other atoms.

The opposite of this state, the 'bound' state, has been introduced as a means of explaining the stability of atomic nuclei, despite the enormous repulsive forces between the protons in these nuclei. It led to the phenomena “strong and weak forces” in atomic nuclei and as a result to the phenomenon “binding energy”, see reference [5], but also to the phenomenon “separation energy”, described in reference [6] as:

“In nuclear physics, separation energy is the energy needed to remove one nucleon (or other specified particle or particles) from an atomic nucleus.”

Applying such a definition to the fission equation in section 2 leads to the conclusion that, with respect to the element Krypton,  $235-92+2 = 145$  nucleons have been removed from the Uranium nucleus, but seen from the element Barium  $235-141+2 = 96$ , showing an unacceptable conflicting situation.

Besides that: what is the binding/separation energy per nucleon? And does it matter whether it is a proton or a neutron? In the example 36 protons and 109 neutrons, *with respect to Krypton*, have been separated.

The phenomenon “mass defect” is explained in [5] (The addition *unbound* in the “i.e.” is of the author.):

“Mass defect = (unbound system calculated mass) – (measured mass of system)  
i.e. (sum of *unbound* masses of protons and neutrons) – (measured mass of nucleus)”

Remark:

The word “defect” in [5] has been replaced by the word “change” in the edition of 5 October 2021, or earlier. The elucidation sounds: “Mass change (decrease) in bound systems, particularly atomic nuclei, has also been termed mass defect, mass deficit, or mass packing fraction.”

The word “deficit” unambiguously means “shortage”, so “mass defect/deficit” is unambiguously meant to be negative. However the words “change” and “mass packing fraction” can be interpreted as positive as well as negative. This ambiguity has been investigated closer.

Given the example in section 2, *unbound* nucleons with a total mass of  $m_u$  (in the example expressed by 234.857 amu on the right side) did have before fission in the U-nucleus a total mass of *bound* nucleons of 235.044 amu, here indicated as  $m_b$ <sup>1</sup>. So the unambiguous positive assigned mass change ( $m_b - m_u$ ) is supposed to be stored in the nucleus as *binding* energy, represented by  $E_b = (m_b - m_u) \cdot c^2$ , so  $E_b$  is positive. The correctness of the presented mass values in amu’s cannot be checked fundamentally. The values as shown on Internet have to be accepted as correct.

Another approach is to take the hypothetical *complete* fission of the atom of isotope <sup>12</sup>C. This isotope is chosen for its role in the determination of the amu/u/Da.

The examination of this hypothetical fission will start with the determination of the total mass of all the constituent particles. Reference [7] shows the *unbound* masses of the neutron, proton and electron<sup>2</sup> as:

$m_n$	$1.67492749804 \cdot 10^{-27}$	kg
$m_p$	$1.67262192369 \cdot 10^{-27}$	kg
$m_e$	$9.1093837 \cdot 10^{-31}$	kg
totally	$3.34846036010 \cdot 10^{-27}$	kg

The isotope <sup>12</sup>C is built up by 18 particles in the configuration: 6 \* (a proton, a neutron and an electron). The total *unbound* mass of this configuration thus is  $6 * 3.34846036010 \cdot 10^{-27} = 2.00907621606 \cdot 10^{-26}$  kg.

The hypothetical fission, in advance directly expressed in mass, is shown as follows:

$$m(^{12}\text{C}) \rightarrow \text{mass of 6 times an } \textit{unbound} \text{ (proton + neutron + electron) + } E = 6 * (m_p + m_n + m_e) + E$$

<sup>1</sup> The definition of mass defect explicitly states that  $m_b$  has been measured, in whatever way.

<sup>2</sup> The atomic mass unit refers to the mass of the whole atom, not of only its nucleus!

Reference [7] defines the ‘unified atomic mass unit’ (u) as  $1.66053906660 \cdot 10^{-27}$  kg, but also claims that the ‘atomic mass constant’ ( $m_u$ ), presented as  $m_u = (1/12)m(^{12}\text{C})$ , has the same mass. The variable  $m(^{12}\text{C})$  is defined as the “*measured* mass of the system”. For  $m_u = 1.66053906660 \cdot 10^{-27}$  kg the mass of  $m(^{12}\text{C})$  thus is:  $1.99264687992 \cdot 10^{-26}$  kg. As a result the following three conclusions have to be drawn:

- 1 Based on the definition of “mass defect” the mass change is  $2.00907621606 \cdot 10^{-26} - 1.99264687992 \cdot 10^{-26} = +1.64293361401 \cdot 10^{-28}$  kg. Converted:  $E = +1.47659509391 \cdot 10^{-11}$  J.
- 2 Based on the hypothetical fission equation, the mass change is  $1.99264687992 \cdot 10^{-26} - 2.00907621606 \cdot 10^{-26} = -1.64293361401 \cdot 10^{-28}$  kg. Converted:  $E = -1.47659509391 \cdot 10^{-11}$  J.
- 3 The sign of the “released” energy in the hypothetical fission equation is opposite to the sign of this energy in the example considering the fission of Uranium.

Surprisingly the following quote from reference [8] confirms such contradictions in a manner as if it has to be considered as real physics!

“Nuclear binding energy in experimental physics is the minimum energy that is required to disassemble the nucleus of an atom into its constituent protons and neutrons, known collectively as nucleons. *The binding energy for stable nuclei is always a positive number*, as the nucleus must gain energy for the nucleons to move apart from each other. Nucleons are attracted to each other by the strong nuclear force. *In theoretical nuclear physics, the nuclear binding energy is considered a negative number*. In this context it represents the energy of the nucleus relative to the energy of the constituent nucleons when they are infinitely far apart.”

Apparently the negative energy resulting from the hypothetical fission of  $^{12}\text{C}$  is considered as theoretical nuclear physics.

The blunder did not go unnoticed, but then downplayed to an embarrassingly low level of science, with the words:

*“Both the experimental and theoretical views are equivalent, with slightly different emphasis on what binding energy means.”*

The last, but not least, objection against the prevailing recipe is that it doesn’t contain any ingredient that causes the high-frequency (radioactive) EM radiation, neither during nor after fission! The observed radiation is simply added as text.

#### 4 Revolutionary solution

In chapter XXIII it is argued that the introduction of a neutron, modelled as a proton around which an electron orbits at an extremely short distance, offers many, if not all, solutions to the problems encountered in the current model of the atomic nucleus. Such a neutron has been named newtron.

The model of the atomic *nucleus* is proposed as follows:

- *a neutron is a proton around which an electron orbits at very short distance,*
- *a proton in the nucleus orbits a newtron at a much larger distance*

It has been mathematically proven that in this nuclear model, up to atomic number 118, there is enough space to store 118 protons and 118 newtrons, and that in such a case the radius of the orbiting electron in the newtron can vary between  $10^{-15}$  and  $10^{-14}$  meter. It has also been shown that the lower the atom number the more the orbiting radius of the electron in the newtron can increase. For example:

In a  $^2_1\text{H}$  atom the volume of the nucleus is restricted to a sphere with radius  $\sim 5 \cdot 10^{-11}$  m, meaning that the newtron is roughly restricted to a sphere with a radius of  $10^{-12}$  m, given the proton assumed to orbit the newtron at its turn.

Two properties of the newton emphasize the reliability of its model:

1. Its high energy density, up to 70 TJ/kg occurring at an orbital radius of  $10^{-15}$  m, decreasing linearly with this radius to 7 TJ/kg for  $10^{-14}$  m, in elements around atom number 100.
2. The high frequency and energy of a (nuclear) photon, emitted by a newton in case its orbiting electron jumps out of its orbit, mutually related by  $E^2 = \eta f$ , with  $\eta = 2\pi^2 m_e k^2 q^4 / b = 1.45 \cdot 10^{-51}$  J<sup>2</sup>s.

For example:

Orbiting radius:  $2 \cdot 10^{-15}$  m, resulting in an orbiting velocity of  $3.6 \cdot 10^8$  m/s\*, an energy of the radiated photon of  $5.8 \cdot 10^{-14}$  J, (equal to the kinetic energy of the orbiting electron), with a frequency of  $2.3 \cdot 10^{24}$  Hz and a pulse width/duration of  $1.9 \cdot 10^{-23}$  seconds of the photon.

\* It has been proven in chapter I that Einstein's Special Theory of Relativity has to be rejected, thus also the restriction that velocities higher than  $c$  cannot exist.

## Conclusions

1. The prevailing model of atomic nuclei is based on the compulsive application of  $E = mc^2$ . Even a remarkable contradictory outcome of theory and measurement in nuclear physics has failed to eradicate this undignified way of performing science.
2. Said model shows no source at all for the unavoidable phenomenon associated with nuclear fission: extreme high-frequency EM radiation.
3. Modelling the neutron as an electron orbiting a proton at very short distances and rejecting the expression  $E = mc^2$  eliminates these fundamental problems and leads to the same high energy density results in terms of Joule/kg as has been measured.
4. Dingle's warning [9] must evidently yet be taken seriously: "Since this theory '(STR)' is basic to practically all physical experiments, the consequences if it is false, modern atomic experiments being what they are, may be immeasurably calamitous."
5. Einstein indeed ruined physics by introducing his theories of relativity.

## References

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- [2] [https://www.f.waseda.jp/sidoli/Einstein\\_Relativity.pdf](https://www.f.waseda.jp/sidoli/Einstein_Relativity.pdf)
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- [9] [https://en.wikipedia.org/wiki/Herbert\\_Dingle](https://en.wikipedia.org/wiki/Herbert_Dingle)



## XXXVI About the origin of the universe

*Summary - This consideration argues that the universe must be infinite in time and volume and that most likely already an infinite number of big-bangs must have taken place.*

### 1 Introduction

Philosophizing is playing with words.

On the one hand a philosophical consideration is senseless if the applied essential words are not defined unambiguously.

On the other hand such a consideration is superfluous as soon as that restriction has been fulfilled.

### 2 Definitions

Universe	The earth and the matter around it.
Cosmos	Imaginary universe, being without matter.
Matter	The collection of all protons, neutrons and electrons, shortly: particles.
Neutron	An electron orbiting a proton at extremely small distances, compared to the smallest radius of an orbiting electron around an atomic nucleus. See chapter XXIII.

### 3 Axioms

- 1 Matter cannot be generated out of nothing
- 2 Matter cannot be transformed to nothing
- 3 Universe contains a limited amount of energy

### 4 Hypotheses and the argumentations for their validity

#### 4.1 The cosmos has an infinite volume

If the volume would not be infinite, there has to be a border somewhere. But a border would be a separation between, in this case, two volumes. So outside that border must again be a volume.

This can be repeated endlessly.

#### 4.2 The matter in universe exists (already) infinitely long

If this would not be the case, there would have been a period during which there was no matter at all. This period would then have been infinite long, because a finite period during which there was nothing must have been preceded by a period during which there was matter. Such a model would imply that an endless repetition would go on of 'something posterior to nothing' and 'nothing posterior to something', showing a sequence of events in contradiction with axiom 1 and 2.

#### 4.3 The quantity of matter in universe does not change

If the quantity of matter, to be read as the total number of particles, would in- or decrease, something created out of nothing, respectively nothing created out of something would show up. Both are in contradiction with axiom 1 and 2.

#### 4.4 The quantity of matter in universe is finite

An infinite number of particles means an infinite number of atoms, each representing a certain amount of energy, generated by the orbiting electrons. An infinite amount of energy is in contradiction with axiom 3.

#### 4.5 The volume in which the matter is concentrated is finite

If this volume would be infinite the density of the *restricted* amount of matter would be zero. This contradicts with our observation.

#### 4.6 The volume of the matter changes periodically with time

If the meant volume would be of the same size for an endless long time, the matter at the outside of this volume would never have changed position relative to the centre of this volume. This is contradictive with the character of gravity.

This character means that, whatever the distance between two masses might be, there is always a gravity force. Due to that, whatever small, force these masses will unavoidably come closer to each other in vacuum, because in vacuum is no force to prevent that, except the force created by explosion.

So as long as these explosion-forces are stronger than gravity-forces the volume of the matter will extend until both forces are equal. At that moment the process of shrinking starts.

In principle it is possible that the matter in universe is composed like an atom in which all masses orbit around a central mass. Such a system would have existed and maintained forever. However the sun for example would in the mean time have emitted all her energy. This contradicts with the present situation.

The end result of the process of shrinking is that all the matter is concentrated in one volume, resulting in an explosion of the matter. If it would not explode, the universe like it is now, would not exist.

So the hypothesis under consideration is correct.

### 5 Big-bangs

Based on the axioms and the hypotheses in this consideration the conclusion must be that already an infinite number of big-bangs have been taken place.

## Epilogue

The e-mail below has been sent to about 7500 physicists, ranked from student to professor, inclusive some Nobel Prize Laureates and members of the Nobel Prize Committee for physics.

Dear physicist,

date December 2018

You herewith receive my article: “Special Theory of Relativity based on fraudulent science?”, showing the following conclusions:

1. Einstein's mathematical errors force us to conclude that he should not be regarded as the widespread praised most intelligent scientist ever. He looks much more like a physicist who has, developing his Special Theory of Relativity, practiced physics in an extremely unscientific manner. One can hardly avoid to qualify it as fraudulent science.
2. The scientific establishment has made, about halfway the previous century, an unpardonable mistake by not exposing openly Einstein's unscientific behaviour, regarding his Special Theory of Relativity, but even worse by fundamentally altering Einstein's postulate regarding the speed light and still retaining the same result, without presenting a new theory leading to that same result. Such behaviour also looks much like fraudulent scientific behaviour.
3. The influence of Einstein's unscientific behaviour on the health of physical science is dramatic: all modern physical models and phenomena that are, more or less, based on his Special Theory of Relativity, have to be rejected too. For example: the phenomena space-time, black hole and last but not least:  $E = mc^2$

The so-called CWI at the University of Delft in the Netherlands has been informed separately and explicitly. The Dutch abbreviation CWI means: Commission Scientific Integrity.

Kind regards,

Sjaak Uitterdijk

P.S. The “e-book” titled “Physics since Einstein” is enclosed too.  
Be so kind to consider this book as a Christmas-2018-gift. ☺

The reason for doing so is that publishers who want to have and keep a good relation with the scientific establishment refuse the mentioned book for publishing.

Three of them have been sent a request, immediately resulting in the following replies:

### **Cambridge University Press**

“Thank you for your email. I have read the first few pages of your very short book. I'm afraid Cambridge would not be interested in considering it for publication.”

### **Springer**

“Thanks for sending your manuscript. I have indeed read the prologue. I am sorry to say that the ideas you wish to publish are not so very new, and that they have been considered and refuted many times by expert theorists. So I am afraid we will not be able to help you publish this work.”

### **Wiley-VCH Verlag GmbH & Co**

“Thank you for sending us your proposal, but unfortunately the planned book does not fit into our portfolio.”