Konstantin Meyl

Self-consistent Electrodynamics

The unified theory is evolving, if the discovered potential vortex replaces the vector potential in the dielectric

Self-consistent Electrodynamics

by

Prof. Dr. Konstantin Meyl

Even though one usually calculates capacitor losses with a complex epsilon it still offends the principle of the constant speed of light. Maxwell's term $c^2 = 1/\varepsilon \cdot \mu$ would even entail a physically inexplicably complex speed! With such an offence against basic principles every physicist is asked to search and repair the mistake in the textbooks.

In the present treatise vortex losses get in the place of a postulated and imaginary part of the material constant epsilon. With the use of a microwave oven, the welding of PVC foils or capacitor losses are to be explained. The responsible potential-vortices can be derived without postulate from approved physical laws and their existence can even be proved experimentally.

Incidentally, the substitution for the vector potential A, which has controlled electro-dynamics as impurity since its introduction blocked the look of a unified theory explaining all interactions and physical phenomena. The new view alone justifies all efforts for rebuilding electrodynamics and removing the built-in contradictions.

The unified theory is evolving, if the discovered potential vortex replaces the vector potential in the dielectric

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Self-Consistent Electrodynamics

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Preface

The starting point of my essay is the contradiction between the usual calculation of dielectric losses on the imaginary part of the dielectric constant (permittivity ε) and the definition of the speed of light ($c^2 = 1 / \varepsilon \bullet \mu$). A complex ε would inevitably lead to a complex c and we are already taught in school the constancy of c!
Consequently, the material constant ε should be constant and not complex! (see Chapter 8, table of apreviations, p.85).

I have pointed out this abuse in all my teaching events in Clausthal, Berlin and Heidelberg. I also remember with pleasure the colloquium at the University of Tübingen 2002 where after my talk the assistants in the middle rows could not keep back a wide grin, and the students on the rear rows raved with pleasure when their professors were at loggerheads in the first row about the contradiction.

The error search leads over Poynting's theorem to the vector potential **A**. At this point a new abyss opens. It shows quickly how and where the whole electrodynamics get entangled in contradictions.

The vector potential **A** assumes, as everybody knows that no magnetic monopoles exist. Mathematically expressed it should be

$$\text{div } \mathbf{B} = \text{div rot } \mathbf{A} = 0 .$$

(Called the 3rd equation of Maxwell).

On the 16th of October, 2009 sixteen authors reported in the magazine "*Science*" about the discovery of magnetic monopoles [1-7 und 4-1]. For the vector potential and all derivations constructing it, this new discovery means the final death blow from the mathematical-physical view.

Superficial amateur physicists will likely suggest that the Helmholtz society and the universities involved in the discovery may not use **A** anymore, while all the others must continue as if nothing has happened.
Or one agrees to the fact that **A** only from Tuesday till Thursday remains valid and puts all lectures to the electrodynamics in this period.

However, those who pursue responsible science, know that a new way must be found. A way to electrodynamics free of contradictions, without vector potential **A** and without complex ε!

Vortex physics offers such a way free from contradictions, with the derivation of potential vortices by a potential density vector **b** which adequately substitutes for the outdated vector potential. Also the dielectrically losses, from now on as vortex losses of disintegrating potential vortices can be calculated in the electrodynamics free of contradiction without complex ε.
Besides, **b** is by no means postulated but is derived from approved physical legitimacies according to textbooks.

The title picture shows the scientist Ruder Boscovic (1711-1787) born in Dalmatia. He should be viewed as the founder of the modern field theory and as a mentor concerning the question standing in the centre of a uniform physical theory will be disclosed in the second half of the book (from the 5th chapter).

The derivation from **b** successfully used approach is applied for the second time. If gravity and electromagnetic interaction are equally derived, then the extracted dependence of all longitudinal dimensions from the field was already explained in 1755 by Boscovic as a "*Breathing of the Earth*".

The result is the theory of objectivity, which I developed in 1992 with its transformation rules, takes the last secrets from physics. Exemplarily the neutrino with its known qualities is derived.

If the foundation is created in theoretical physics hopes for a technical use of Neutrinopower as an energy resource of the future are legitimate.

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1. Losses in the alternating field

If we expose matter to an alternating field we usually observe it heating up. The resulted heat energy corresponds to the losses of the alternating field. At the investigation of the cause the frequency dependence often delivers valuable tips. We also observe typical differences between magnetic and electric losses depending on the material.

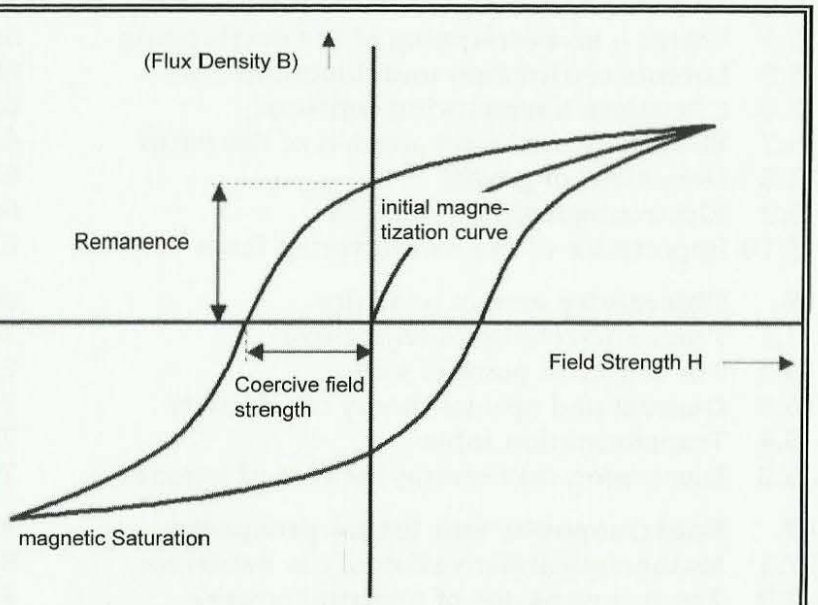


Fig. 1: The Hysteresis-losses of a magnetic circuit are proportional to the area of the hysteresis loop outlined by the change of polarity.

1.1 Ferromagnetic Losses

In a magnetic circle, for example a transformer or an electric motor, ferromagnetic materials are used which distinguish themselves by a high permeability μ. Changing polarity in the alternating magnetic field the B(H) - magnetization curve with its typical hysteresis is run through (Fig. 1).

Proportionally to the surface, which is outlined by the hysteresis curve and also to the frequency of the cycles, (i.e. to the frequency of the stimulation), losses originate in the magnetic circle warming it up subsequently.

These conversion losses appear, as a result of the crystalline material structure, (i.e. iron, cobalt or nickel). On the other hand almost all the other materials don't show any of these hysteresis phenomena, which is why the ferromagnetica form a rather rare and special exception.

However, conductive materials like silver, copper or aluminum heat up only by electrical currents and eddy-currents.

1.2 Polarization Losses

Dielectrics, as they are used in capacitors and for insolating materials, distinguish themselves by a low electric conductivity which is why no eddy-currents are to be expected. Besides, potential-vortices and the accompanying vortex losses are totally unknown in the valid field theory which is why we must continue to search for the reasons why a non-conductor gets hot.

Electrets and other ferroelectric materials with a distinctive hysteresis D(E) - characteristics [i.e. barium titanate] are extremely rare. Because the material should be blamed for the measurable losses, the polarization of the material still remains as a possible reason for losses.

As a consequence of change in polarity with high frequencies the dielectric displacement D follows the electric field strength E time-delayed. The produced loss factor δ represents the dielectric losses – This is what we learn from our textbooks [1-1: Küpfmüller p.153].

However, this entails the afore said complex dielectric coefficient:

$$\varepsilon = \mathrm{Re}\{\varepsilon\} + j\,\mathrm{Im}\{\varepsilon\} \qquad (1.1)$$

with the loss factor $$\tan\delta = \mathrm{Im}\{\varepsilon\} / \mathrm{Re}\{\varepsilon\} \ . \qquad (1.2)$$

which results directly in a complex speed of light according to the definition

$$\varepsilon\cdot\mu = 1/c^2 \ , \qquad (1.3)$$

which is an offence against the basic principles of physics!

A transient hysteresis D(E) - characteristic would also have to appear with dielectrically, but non-ferroelectric, materials. This is verified by the frequency dependency because a direct proportionality to an increasing frequency would be expected. However, the technologically important insulating materials show a widely constant loss factor. Leaving the question, which physical phenomenon heats up an insulator?

1.3 The error search

In spite of offence against the constance of the speed of light the complex epsilon belongs to the inalienable toolbox of every electrical engineer. He will not want this tool to be taken from him. Practical people think and act pragmatically: *"if no better theory is available"*, many argue, *"then a wrong theory is still better than none"*.
With this reasoning even uninvestigated dielectrically losses are considered and summed up under the loss factor (1.2). At least, this physically wrong model is in many cases able to deliver useful arithmetic values [1-1 Küpfmüller p.157]. We can say, *"the description is harmlessly wrong"*, from the mathematics' point of view.

However for a member of theoretical physics, who is confronted with a complex speed of light, the complex dielectricity ε marks the end of all efforts. If the result of a derivation turns out wrong the mistake is either in the approach or in the derivation.

The latter is presumably perfect, after generations of students had to check the calculations year after year. At some point a mistake had to appear. Under these circumstances the mistake quite obviously lies in the approach, in the basic acceptance of classical electrodynamics [1-2 Jackson].

Here the vector potential **A** is introduced mathematically correct. From the physical view this is still a foreign body in the field theory. In addition, vector potential and potential-vortex exclude themselves mutually. We will have to decide whether to calculate dielectric losses with a complex Epsilon or with a vortex decay, because doing so both ways at the same time is mathematically impossible.

1.4 The field theory from Maxwell's desk

With his book "*A Treatise on Electricity and Magnetism*" [1-3] from 1865 **James Clerk Maxwell**, professor of mathematics, pursued an ambitious aim to derive the wave equation of **Laplace** from an equation sentence about the electric and magnetic field to describe the light as an electromagnetic wave.
The enlarged representation by means of quaternions from 1874 with its mathematical description of potential-vortices, scalar waves and many unconfirmed phenomena exceeded the physical phenomena experimentally provable in the past. Therefore, a vector potential was not necessary in the depiction.

Only in 1888 was one of the numerous phenomena proven experimentally by **Heinrich Hertz** in Karlsruhe (Germany), concerning the electromagnetic wave. Eddy-currents were also recognized together with the laws by **Ampère**, **Faraday**, and **Ohm**. This is why **Heaviside** suggested shortening the field equations of **Maxwell** to both proven phenomena. The professors **Hertz** and **Gibbs** agreed with him.

Since then the field theory has not been able to describe longitudinal waves even though they had been proved by **Tesla** in 1894 [1-4 SWT Meyl]; and they have had to be postulated over and over again, for example in the near field of an antenna [1-5 Zinke, Brunswig].

1.5 The vector potential A

To describe other secured facts of the electrodynamics, for example dielectric losses, **Maxwell** had already considered the introduction of a vector potential:

$$\mathbf{B} = \text{curl}\,\mathbf{A} \qquad (1.4)$$

As a consequence of this mathematical statement the divergence of the magnetic induction B is zero.

$$\text{div}\,\mathbf{B} = \text{div curl}\,\mathbf{A} = 0 \qquad (1.5)$$

J.D.Jackson [1-2] and his followers [1-6 Lehner] viewed magnetic monopoles in curl **B**. As long as they they do not exist, the field physicists want to see a confirmation for the correctness of Eq. 1.4 (3rd Maxwell equation). This was the way of thinking until now.

On September 3rd 2009, the **Helmholtz centre** in Berlin, Germany, announcemented [1-7 Science, and others]: "*Magnetic monopoles proven for the first time*". With this discovery in a magnetic solid state the vector potential with all its calculations is no longer viable, in spite of the correctness and verifiability of all present results. One can also say, "*we must start all over again and consider a new approach*".
I suggest a vortex description completely without vector potential **A** and with

$$\text{div}\,\mathbf{B} \neq 0 \qquad (1.6)$$

With my approach even the **Aharonov Bohm** effect is explainable where scalar waves are generated and verified after they have tunneled through a screening. According to today's interpretation [1-6: Lehner, p.541] the effect where no field is measurable is assigned to the vector potential and even speaks of evidential value!

1.6 Helmholtzian ring-like vortices in the aether

The doubts about the classical electrodynamics are not new. In 1887 **Nikola Tesla** demonstrated his scalar wave experiments to the theoretical physicist **Lord Kelvin** in his lab in New York. He told Kelvin about the meeting with the German Professor **Hermann von Helmholtz** on the occasion of the World's Fair in Chicago 1893. Kelvin knew him very well and had cooperated with him in the past. Now the vortex concept of his colleague and his model of stable vortex rings were very helpful.

In the case of a standing wave the impulse is passed on from one particle to the next. In the case of acoustics we are dealing with a shock wave where one air molecule knocks the next. In this way sound propagates as a longitudinal wave. Correspondingly the question is raised: "*What sort of quanta are the ones, which in the case of the Tesla radiation carry the impulse?*"

Lord Kelvin deduced: "*The Tesla experiments prove the existence of longitudinal standing waves in space*".
In the question, what passes on the impulse, Kelvin comes to the conclusion: it is **vortices in the aether**!
With that he had found an answer in experience.

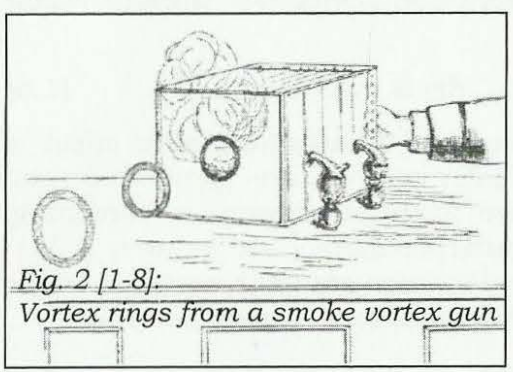


Fig. 2 [1-8]:
Vortex rings from a smoke vortex gun

With his students he built boxes, with which he could produce smoke rings, to be able to study and demonstrate in experiments the special properties of ring-like vortices in their flow technical analogy.

But he didn't have a suitable field theory.

For a short time Germany exported vortex physics in England, before it was buried by the German quantum physicists. A primary advocate was **James Clerk Maxwell**, who held the vortex theory for the best and most convincing description of matter [1-8: James Clerk Maxwell: *"... the vortex rings of Helmholtz, which Thomson imagines as the true form of the atom, fulfill more conditions than any other previous concept of the atom."*].

As his successor at the *Cavendish laboratory in Cambridge* **J. J. Thomson** was appointed to a professorship. As a young man he received an award for a mathematical treatise about vortices. He discovered the electron and imagined it, how could it be otherwise, as a field vortex. [1-8: J.J. Thomson: *"the vortex theory is of much more fundamental nature than the usual theory of solid particles"*].

The crucial weakness of vortex physics, the lacking of an usable field theory, was of benefit to the emerging quantum physics. This could change fundamentally with the discovery of the potential-vortex, the vortex of the electric field [1-9, Meyl 1990].

In addition, the experimental proof of a vortex transmission as a longitudinal wave in air or in a vacuum, as it has been furnished by Tesla already 100 years ago, neither with Maxwell's field theory nor with the today normally used quantum theory explicable or compatible. An urgent need is present for a new field theory!

1.7 Noise power of a capacitor

So we apply vortex physics to a dielectric with a suitable model.

The wave now will rotate round a stationary point, the vortex centre. The propagation with the speed of light c will remain existent as the swirl velocity. For a plane circular vortex, where the path for a revolution on the outside is very much longer than near the vortex center, there arises a longer wave length and as a consequence a lower frequency on the outside and greater on the inside.

With this property the vortex proves to be a ***converter of frequency:*** the vortex transforms the frequency of the causing wave in an evenly spectrum that starts at low frequencies and stretches to very high frequencies.

This property we observe in ***"white noise"***. The consistent conclusion would be that this concerns the vortex of the electric field. Anyone can, without big expenses, convince himself or herself of the localization of the property to change the frequency and of the circumstance that vortices can be very easily influenced and that they avoid or again whirl about a place of disturbance (i.e. an antenna). For that one only needs to tune a radio receiver to a weak and noisy station and move oneself or some objects around, then one is able to directly study the influences from the manipulation of the receiving signal.

But already the fact that the using and measurability of signals is limited by noise makes clear the need to give attention to the potential-vortex.

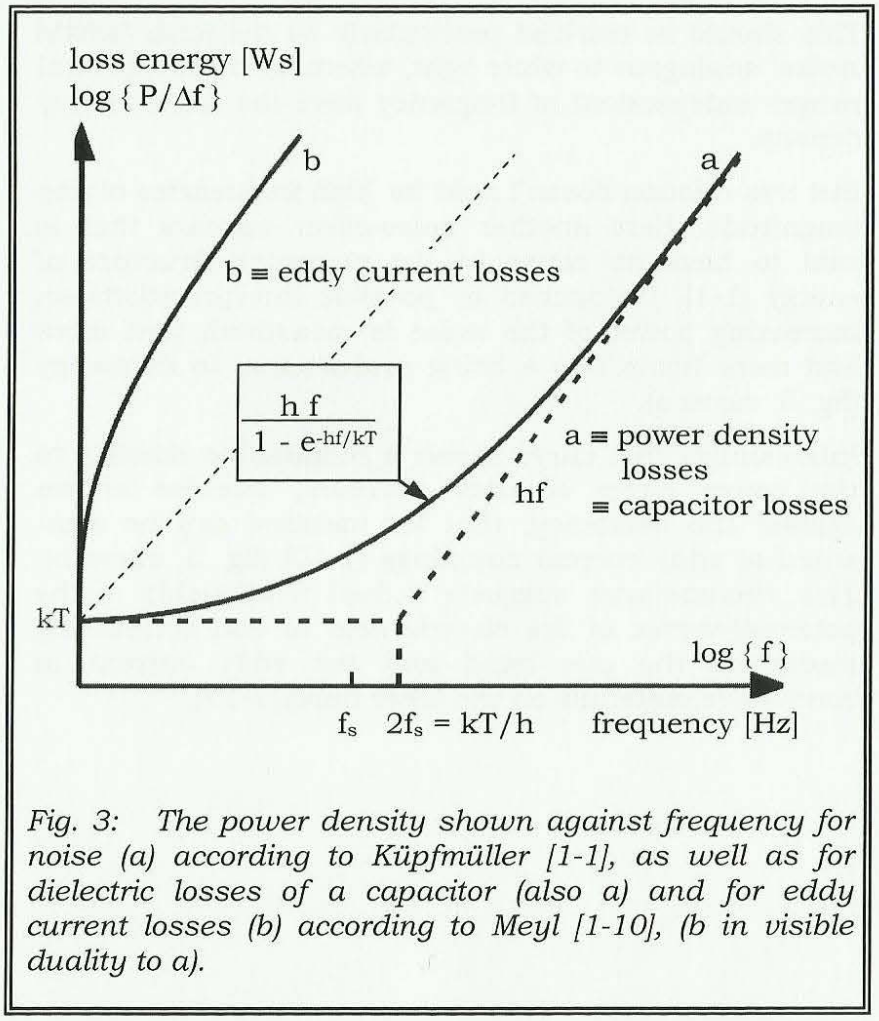


Fig. 3: The power density shown against frequency for noise (a) according to Küpfmüller [1-1], as well as for dielectric losses of a capacitor (also a) and for eddy current losses (b) according to Meyl [1-10], (b in visible duality to a).

Within a limited frequency range the power of the Nyquist or resistance noise is independent of frequency.

This should be clarified particularly by the term ***"white noise"*** analogous to white light, where all visible spectral ranges independent of frequency have the same energy density.

But this relation doesn't hold for high frequencies of any magnitude. Here another noise-effect appears that is said to have its cause in the quantum structure of energy [1-1]. Untouched by possible interpretations an increasing power of the noise is measured, that more and more turns into a being proportional to frequency (fig. 3, curve a).

Interestingly this curve shows a remarkable ***duality*** to the power curve of eddy currents, likewise shown against the frequency, that for instance can be measured at eddy current couplings [1-10] (fig. 3, curve b). This circumstance suggests a dual relationship of the potential-vortex of the electric field in bad conducting media on the one hand and the eddy current in conductive materials on the other hand [1-11].

1.8 Capacitor losses

Next, the dielectric losses in a capacitor is feed with an alternating voltage that are measurable and likewise put on against the frequency. At first the course is independent of the frequency, but towards higher frequencies it increases and shows the same characteristic course of the curve referring to the power of the noise (fig. 3, curve a).

This excellent agreement suggests the assumption that the dielectric losses are nothing but ***eddy losses***.

These vortex phenomena, caused by time-varying fields, are not only found in ferromagnetic and conductive materials but equally as dual phenomena in dielectrics and non-conductors.

As examples of practical applications are induction welding and the microwave oven. The process can be described in other words as follows: in both examples the cause is posed by high-frequency alternating fields that are irradiated into a dielectric as an electromagnetic wave, there roll up to potential-vortices and eventually decay in the vortex centre. The desired and used thermal effect arises during this diffusion process.

1.9 The visible proof

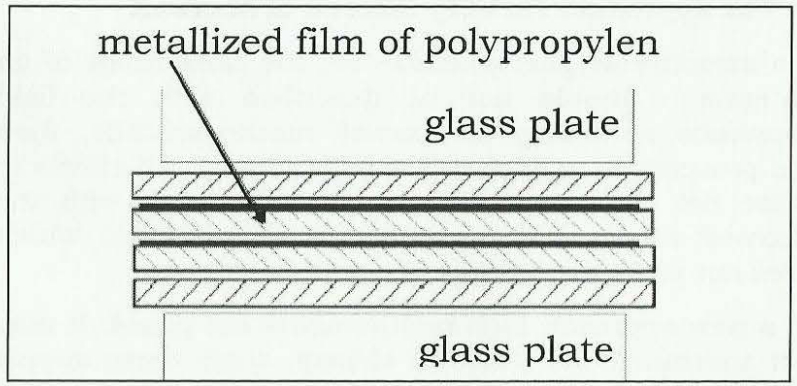
The striving in the direction of the vortex centre gives the potential-vortex of the electric field a ***structure shaping property***. As a consequence of this ***concentration effect*** circular vortex structures are to be expected comparable to the visible vortices in flow dynamics (i.e. tornados and whirlwinds).

At the same time the dual anti-vortex arises so does the diverging eddy current. It takes, as is well-known, the given structure of the conductor so in the technical literature one correspondingly talks of a "***skin effect***".

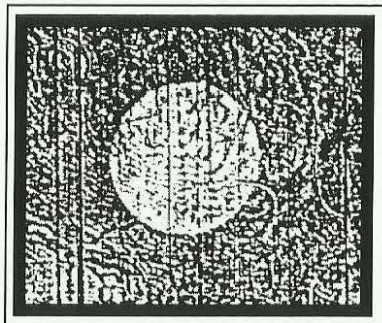
Now if conductor and non-conductor meet as they do in a capacitor then at the boundary area visible structures will form. Circles would be expected, if the eddy current in the inside and striving to the outside is equally powerful as the **potential-vortex** that comes from the outside and concentrates.

Actually such circular structures are observed on the aluminum of high tension capacitors when they are in operation for a longer period of time. The formation of these circles, the cause of which until now is considered to be unsolved, is already experimentally investigated and discussed on an international level by scientists [1-12, 1-13].

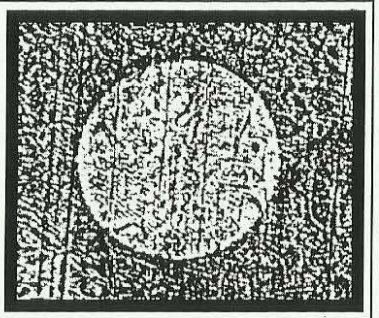
These circular vortex structures can be seen as a visible proof for the existence of potential-vortices of the electric field [1-11].



a) measurement set up according to Yializis and others [1-12]



b) after 40 hours



c) after 52 hours

Fig. 4: Measurement set up (a) and photo of vortex structure in a metalized polypropylene layer capacitor at 450 V/ 60 Hz/ 100°C and 110 fold magnification Observation of the formation of a vortex (b) and (c). according to Yializis et al. [1-12].

2. The approach: Faraday instead of Maxwell

If a measurable phenomenon– i.e. the close range of an antenna - should not be described with the field equations according to Maxwell mathematically, then the prospect is to explore a new approach. All efforts to prove the correctness of the Maxwell theory with the Maxwell theory end inevitably in a tail-chase, which does not prove anything in the end.

In a new approach high requirements are posed. It may not contradict the **Maxwell theory**, since these supply correct results in most practical cases and may be seen as confirmed. It would be only an extension permissible, in which the past theory (without Vector potential **A**) is contained as a subset i.e.
Let's go on the quest.

2.1 Vortex and Anti-vortex

In the eye of a tornado the same calm prevails as at great distance, because here a vortex and its anti-vortex work against each other. In the inside the expanding vortex is located and on the outside the contracting anti-vortex. One vortex is the condition for the existence of the other one and vice versa. Already **Leonardo da Vinci** knew both vortices and has described the dual manifestations [2-1: Lugt, p. 356].

In the case of flow vortices the viscosity determines the diameter of the vortex tube where the coming off will occur. If for instance a tornado soaks itself with water above the open ocean then the contracting potential-vortex is predominant and the energy density increases threateningly. If the tornado runs overland and rains out, it again becomes bigger and less dangerous.

In fluid dynamics the influences are understood. They are usually also well visible and without further aids observable.

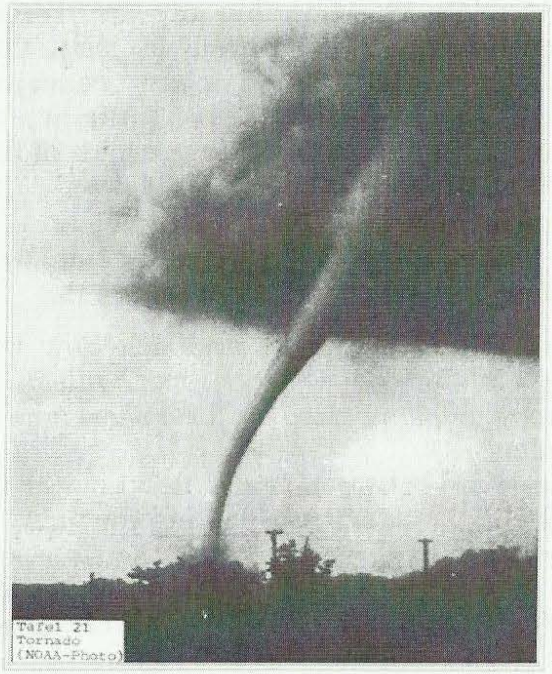


Fig.: 4 [2-1]: The Tornado i.e. shows a physical basic principle of vortex and anti-vortex

In electrical engineering it's different: here field vortices remain invisible. Only so a theory could find acceptance, although it only describes mathematically the expanding eddy current and ignores its anti-vortex. I call the contracting anti-vortex "**potential-vortex**" and point to the circumstance, that every eddy current entails the anti-vortex as a physical necessity. By this reconciliation it is insured that the condition in the vortex center corresponds in the infinite one, complete in analogy to fluid mechanics.

2.2 The Maxwell approximation

The approximation of which is hidden in the Maxwell equations, thus consists in neglecting the anti-vortex dual to the eddy current. It is possible that this approximation is allowed, as long as it only concerns processes inside conducting materials. The transition to insulating materials however requires for the laws of the field refraction steadiness, and incompatible with the acceptance of eddy currents in the cable and a nonvortical field in air. In such a case, the Maxwell approximation will lead to considerable errors.

If we take as an example lightning and ask how the lightning channel is formed: "*Which mechanism is behind it if the electrically insulating air for a short time is becoming a conductor*"?
From the viewpoint of vortex physics the answer is obvious: The potential-vortex, which in the air is dominating, contracts very strong and doing so squeezes all air charge carriers and air ions, which are responsible for the conductivity together at a very small space to form a current channel.

The contracting potential-vortex thus exerts a pressure and with that forms the vortex tube. Besides the cylindrical structure another structure can be expected. It is the sphere, which is the only form that can withstand a powerful pressure equally from all directions of space. Think of a ball lightning.

We imagine now a spherical vortex, in whose inside an expanding vortex is enclosed and which is held together from the outside by the contracting potential-vortex and is forced into its spherical shape. From the infinite measured this spherical vortex would have an electrical charge and all the characteristics of a charge carrier.

Inside:	expanding eddy current (skin effect)
Outside:	contracting anti-vortex (potential-vortex)
Condition	for coming off: equally powerful vortices
Criterion:	electric conductivity (determines diameter)
Result:	spherical structure (consequence of the pressure of the vacuum)

Fig. 6: The electron as an electromagnetic sphere-vortex

2.3 The magnetic monopole

With the tendency of the potential-vortex for contraction, inevitably the ability is linked to a structural formation. The particularly obvious structure of a ball would be a useful model for quanta.

A to the sphere formed field-vortex would be described mathematically in its inside with the expanding vortex div **D**. For the potential-vortex working against from the outside div **B** would apply. The divergence may not be set with neither the electrical field (4th Maxwell equation) nor with the magnetic field (3rd Maxwell equation) to zero!

However, both equations are necessary for the derivation of an electron, then it is a mistake in reasoning to assign one alone to an electrical and the other one to a magnetic monopole.

Since the radius at which it comes to a vortex, detaching the size of the sphere vortex depends on its conductivity, electrical monopoles, and among them rank numerous elementary particles would be extremely small. However, Magnetic monopoles would have to take enormous, no longer for us measurable dimensions.

2.4 The discovery of the law of induction

In the choice of the approach the physicist is free as long as the approach is reasonable and well founded. In the case of **Maxwell's field equations** two experimentally determined regularities served as basis: On the one hand, **Ampère's law** and on the other hand the **law of induction of Faraday**.

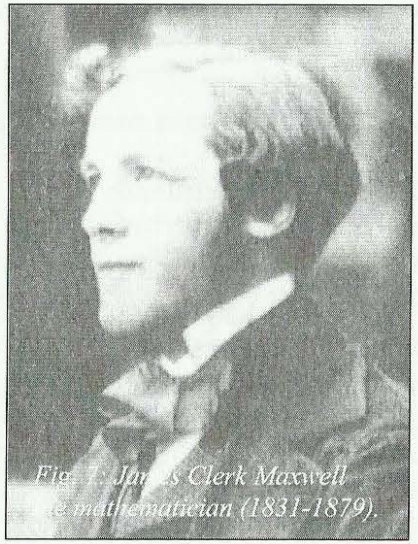


Fig. 7: James Clerk Maxwell the mathematician (1831-1879).

Maxwell, the mathematician, thereby gave the finishing touches for the formulations of both laws. He introduced the displacement current **D** and completed Ampère's law accordingly, and doing so without a chance of being able to measure and prove the measure. Only after his death this was possible experimentally, what afterwards makes clear the abilities of this man.

In the formulation of the law of induction, **Maxwell** was completely free because the **discoverer Michael Faraday** had done so without specifications. As a man of practice and of experiment the mathematical notation was less important for Faraday. For him the attempts with which he could show his discovery of the induction to everybody (i.e. his unipolar generator), stood in the foreground.
However, his 40 years younger friend and professor of mathematics Maxwell had something completely different in mind. He wanted to describe the light as an electromagnetic wave and doing so certainly the wave

description of Laplace went through his mind, which in turn needs a second time derivation of the field factor. Because Maxwell for this purpose needed two equations with each time a first derivation, he had to introduce the displacement current in Ampère's law and had to choose an appropriate notation for the formulation of the law of induction to get to the wave equation.

His light theory initially was very controversial. Maxwell faster found acknowledgement for bringing together the teachings of electricity and magnetism and the representation as something unified and belonging together [2-2] than for mathematically giving reasons for the principle discovered by Faraday.

Nevertheless, questions should be asked.

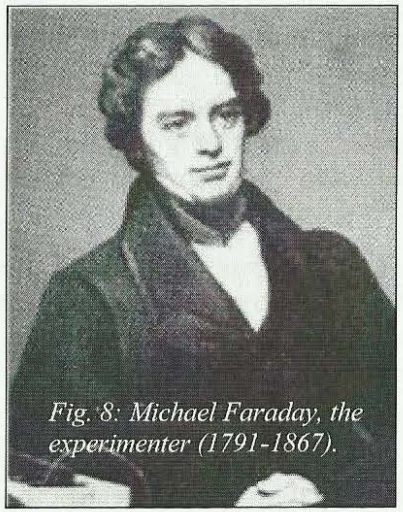


Fig. 8: Michael Faraday, the experimenter (1791-1867).

* If Maxwell has found the suitable formulation, if he has understood 100 percent correct his friend Michael Faraday's discovery.
* If the discovery (from August 29th 1831) and the mathematical formulation (1862) stem from two different scientists, who in addition belong to different disciplines, thus it is not unusual for misunderstandings to occur. It will be helpful to work out the differences.

2.5 The unipolar generator

If one turns an axially polarized magnet or a copper disc situated in a magnetic field, then perpendicular to the direction of motion and perpendicular to the magnetic field pointer a pointer of the electric field will occur, which everywhere points axially to the outside. In the case of this by **Michael Faraday**, he developed a **unipolar generator** - by means of a brush between the rotation axis and the circumference a voltage is picked off.

The mathematically correct relation $\mathbf{E} = \mathbf{v} \times \mathbf{B}$ (2.1)

I call this the "*Faraday-law*", despite the fact that it appears in this form in textbooks later in time [2-3 Pohl]. The formulation usually is attributed to the mathematician **Hendrik Lorentz**, since it appears in the **Lorentz force** in exactly this form. Much more important than the mathematical formalism are the experimental results and the discovery by Faraday, for which the law concerning unipolar induction is named after him the "**Faraday-law**".

Of course we must realize that the charge carriers at the time of the discovery hadn't been discovered yet and the field concept couldn't correspond to that of today. The field concept is an abstracter one, free of any quantization.

That of course is also valid for the field concept advocated by Maxwell, which we now contrast with the „*Faraday-law*" (fig. 9). The second Maxwell equation, the law of induction (2.2), also is a mathematical description between the electric field strength **E** and the magnetic induction **B**. But this time the two aren't linked by a relative velocity **v**.

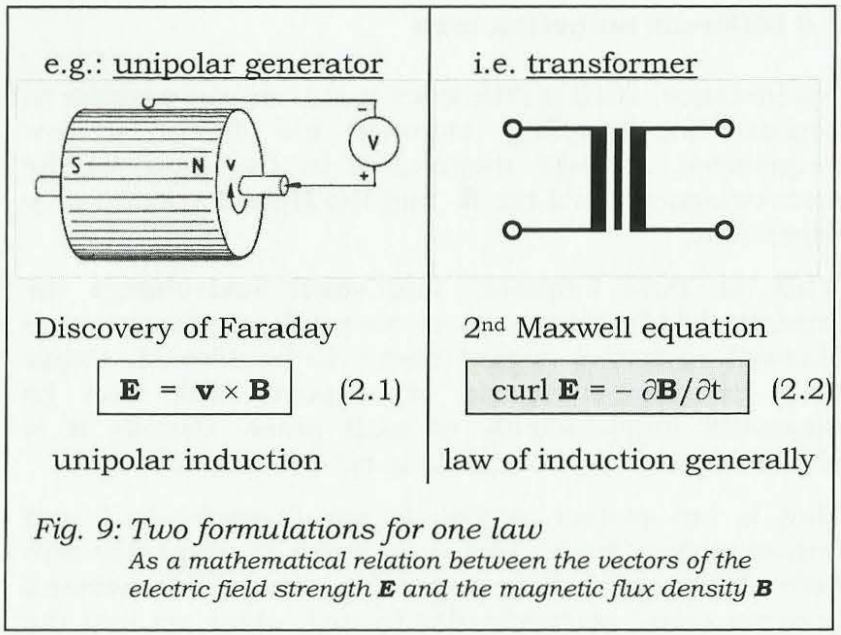


Fig. 9: Two formulations for one law
*As a mathematical relation between the vectors of the electric field strength **E** and the magnetic flux density **B***

In place stands the time derivation of **B**, with which a change in flux is necessary for an electric field strength to occur. As a consequence the Maxwell equation doesn't provide a result in the static or quasi-stationary case. In such cases it is usual to fall back upon the unipolar induction according to Faraday (e.g. in the case of the Hall-probe, the picture tube, etc.). The falling back should only remain restricted to such cases, so the normally idea is used. The question then asked: "*Which restriction of the "Faraday-law" to stationary processes is made?*"
The vectors **E** and **B** can be subject to both spatial and temporal fluctuations. In that way the two formulations suddenly are in competition with each other and we are asked to explain the difference, as far as such a difference should be present.

2.6 Different induction laws

For instance, such a difference it is common practice to neglect the coupling between the fields at low frequencies. At high frequencies in the range of the electromagnetic field the **E**- and the **H**-field are mutually dependent.

While at lower frequency and small field change the process of induction drops correspondingly according to Maxwell so that a neglect seems to be allowed. Under these conditions electric or magnetic field can be measured independently of each other. Usually it is proceeded as if the other field is not present at all.

That is not correct. A look at the "*Faraday-law*" and immediately it shows that even down to frequency zero both fields are always present. The field pointers however stand perpendicular to each other, so that the magnetic field pointer wraps around the pointer of the electric field in the form of a vortex ring. In this case the electric field strength is being measured and vice versa. The closed-loop field lines are acting neutral to the outside; so is the normal used idea. However they need no attention.

It should be examined more closely if this is sufficient as an explanation for the neglect of the not measurable closed-loop field lines or, if not after all, an effect arises from fields which are present in reality.

Another difference concerns the commutability of **E**- and **H**-field, as is shown by the Faraday-generator, how a magnetic field becomes an electric field and vice versa as a result of a relative velocity v. This directly influences the physical-philosophic question: "*What is meant by the electromagnetic field*?"

2.7 The electromagnetic field

The textbook opinion, based on the *Maxwell equations*, names the static field of the charge carriers as cause for the electric field, whereas moving ones cause the magnetic field [e.g. 2-4]. But that could not have been the idea of **Faraday**, to whom the existence of charge carriers was completely unknown.

For his contemporaries, completely revolutionary abstract field concept, based on the works of the **Croatian Jesuit priest Boscovic** (1711-1778). In the case of the field it should less concern a physical quantity in the usual sense, than rather the "*experimental experience*" of an interaction according to his field description.

We should interpret the "*Faraday-law*" to the effect that we experience an electric field if we are moving with regard to a magnetic field with a relative velocity and vice versa.

In the commutability of electric and magnetic field a duality between the two is expressed, which in the Maxwell formulation is lost as soon as charge carriers are brought into play. The question then becomes, "*Is the Maxwell field the special case of a particle free field*?" Much evidence points to the answer as "*yes*", because, after all, a light ray can run through a particle free vacuum. As we see, fields can exist without particles but particles without fields are impossible! In conclusion, the field should have been there first as the cause for the particles. The Faraday description should form the basis from which all other regularities can be derived.

What do the textbooks say to that?

2.8 Contradictory opinions in textbooks

Obviously there exist two formulations for the law of induction (2.1 and 2.2), which more or less have equal rights. Science stands for the questions: "*Which mathematical description is the more efficient one? If one case is a special case of the other case, which description then is the more universal one?*"

What Maxwell's field equations tell us is sufficiently known so that derivations are unnecessary. Numerous textbooks are standing by, if results should be cited. Let us hence turn to the "*Faraday-law*" (2.1). Often one searches in vain for this law in schoolbooks. Only in more pretentious books one makes a find under the keyword unipolar induction. If one compares the number of pages which are spent on the law of induction according to Maxwell with the few pages for the unipolar induction, then one gets the impression that the later is only a unimportant special case for low frequencies.

Prof. **Küpfmüller** (TU Darmstadt) speaks of a "*special form of the law of induction*" [2-4, p.228, eq.22], and cites as practical examples the induction in a brake disc and the Hall-effect. Afterwards Küpfmüller derives from the "*special form*" the "*general form*" of the law of induction according to Maxwell, a postulated generalization, which needs an explanation. But a reason is not given.

Prof. **Bosse** (as successor of Küpfmüller at the TU Darmstadt) gives the same derivation, but for him the Maxwell-result is the special case and not the Faraday approach [2-5: Bosse, p.58]! In addition he addresses the "*Faraday-law*" as an equation of transformation, points out the meaning, and the special interpretation.

On the other hand he derives the law from the "*Lorentz force*", completely in the style of Küpfmüller [2-4] and with that again takes part of its autonomy.

Prof. **Pohl** (University of Göttingen, Germany) looks at that differently. He inversely derives the "*Lorentz force*" from the "*Faraday-law*" [2-3: Pohl, p.77]. We should follow this very convincing representation.

2.9 The equation of convection

If Bosse [2-5] prompted term "*equation of transformation*" is justified or not is unimportant at first. That is a matter for discussion.

If there should be talk about "*equations of transformation*", then the dual formulation (to equation 2.1) belongs to it, and then it concerns a **pair of complementary equations** which describes the relations between the electric and the magnetic field.

The **new and dual field approach** consists of

equations of transformation

of the electric		and	of the magnetic field	
$\mathbf{E} = \mathbf{v} \times \mathbf{B}$	(2.1)	and	$\mathbf{H} = -\mathbf{v} \times \mathbf{D}$	(2.3)
unipolar induction			***equation of convection***	

with the **E**-field $\mathbf{E}(\mathbf{r},t)$ and the **H**-field $\mathbf{H}(\mathbf{r},t)$
resp. the **D**-field $\mathbf{D}(\mathbf{r},t)$ and the **B**-field $\mathbf{B}(\mathbf{r},t)$.

Written down according to the rules of duality there results an equation (2.3), which occasionally is mentioned in some textbooks.

While both equations in the books of **Pohl** [2-3, p.76 and 130] and of **Simonyi** (University of Budapest, Hungary)[2-6, p.924] are written down side by side having equal rights and are compared with each other, **Grimsehl** [2-7, p.130] derives the dual regularity (2.3) with the help of the example of a thin, positively charged, and rotating metal ring. He speaks of "*equation of convection*" as moving charges produce a magnetic field and so-called convection currents. Doing so he refers to workings of **Röntgen** 1885, **Himstedt**, **Rowland** 1876, **Eichenwald** and many others.

In his textbook **Pohl** also gives practical examples for both equations of transformation. He points out that one equation changes into the other one, if as a relative velocity v the speed of light c should occur [2-3, p.77].

3. The derivation from text book physics

We now have found a field-theoretical approach with the equations of transformation, which in its dual formulation is clearly distinguished from the Maxwell approach. The reassuring conclusion is added: **The new field approach roots entirely in textbook physics**, and are the results from literature research.

We can completely do **without postulates**!

The next step is to test the approach utilizing mathematics for freedom from contradictions. In particular is the question, "*Which known regularities can be derived under which conditions?*" Moreover, the conditions and the scopes of the derived theories should result correctly (i.e. of what the Maxwell approximation consists and why the Maxwell equations describe only a special case).

3.1 Derivation of the field equations after Maxwell

As a starting-point and as approach serve the *equations of transformation* of the electromagnetic field, the "*Faraday-law*" of *unipolar induction* (2.1) and the according to the rules of duality formulated law called *equation of convection* (2.3).

$$\boxed{\mathbf{E} = \mathbf{v} \times \mathbf{B}} \quad (2.1) \quad \text{and} \quad \boxed{\mathbf{H} = -\mathbf{v} \times \mathbf{D}} \quad (2.3)$$

If we apply the curl to both sides of the equations:

$$\boxed{\text{curl}\ \mathbf{E} = \text{curl}\ (\mathbf{v} \times \mathbf{B})}\ (3.1), \boxed{\text{curl}\ \mathbf{H} = -\text{curl}\ (\mathbf{v} \times \mathbf{D})}\ (3.2)$$

then according to known algorithms of vector analysis the curl of the cross product each time delivers the sum of four single terms [3-1 Bronstein]:

$$\text{curl } \mathbf{E} = (\mathbf{B} \text{ grad})\mathbf{v} - (\mathbf{v} \text{ grad})\mathbf{B} + \mathbf{v} \text{ div } \mathbf{B} - \mathbf{B} \text{ div } \mathbf{v} \quad (3.3)$$

$$\text{curl } \mathbf{H} = -[(\mathbf{D} \text{ grad})\mathbf{v} - (\mathbf{v} \text{ grad})\mathbf{D} + \mathbf{v} \text{ div } \mathbf{D} - \mathbf{D} \text{ div } \mathbf{v}] \quad (3.4)$$

Two of these again are zero for a constant relative motion $\mathbf{v}(\mathbf{r}) = d\mathbf{r}/dt$ all along the curve given by $\mathbf{r}(t)$:

$$(\mathbf{B} \text{ grad})\mathbf{v} = 0 \quad \text{resp.} \quad (\mathbf{D} \text{ grad})\mathbf{v} = 0 \quad (3.5)$$

(acc. to the derivation given in the mathematical appendix of the book [1-4] on page 68 ff.)

and $$\mathbf{B} \text{ div } \mathbf{v} = 0 \quad \text{resp.} \quad \mathbf{D} \text{ div } \mathbf{v} = 0 \quad (3.5^*)$$

One term concerns the vector gradient $(\mathbf{v} \text{ grad})\mathbf{B}$, which can be represented as a tensor. By writing down and solving the accompanying derivative matrix the vector gradient becomes a partial time derivation of the field vector $\mathbf{B}(\mathbf{r},t)$ to t,

(3.6)

$$(\mathbf{v} \text{ grad})\, \mathbf{B}(\mathbf{r},t) \Big|_{\mathbf{r}(t)} = \frac{\partial \mathbf{B}(\mathbf{r},t)}{\partial t} \quad \text{and} \quad (\mathbf{v} \text{ grad})\, \mathbf{D}(\mathbf{x},t) \Big|_{\mathbf{r}(t)} = \frac{\partial \mathbf{D}(\mathbf{r},t)}{\partial t}$$

Easily provable by looking at the components [1-4] in $\mathbf{r} \in R^3$ and $t \in [0, \infty)$:

$$(\mathbf{v} \text{ grad})\, \mathbf{B} = \left(\frac{\partial x}{\partial t}\cdot\frac{\partial B_x}{\partial x} , \frac{\partial y}{\partial t}\cdot\frac{\partial B_y}{\partial y} , \frac{\partial z}{\partial t}\cdot\frac{\partial B_z}{\partial z} \right) = \frac{\partial \mathbf{B}}{\partial t} \quad (3.7)$$

For the final not yet explained terms are written down the vectors **b** and **j** as abbreviations.

$$\text{curl } \mathbf{E} = -\partial\mathbf{B}/\partial t + \mathbf{v} \text{ div } \mathbf{B} = -\partial\mathbf{B}/\partial t - \mathbf{b} \quad (3.8)$$

$$\text{curl } \mathbf{H} = \partial\mathbf{D}/\partial t - \mathbf{v} \text{ div } \mathbf{D} = \partial\mathbf{D}/\partial t + \mathbf{j} \quad (3.9)$$

With equation 3.9 we in this way immediately look at the well-known law of Ampère (1st Maxwell equation).

3.2 The Maxwell equations as a special case

The result will be the **Maxwell equations**, if:

- the potential density $\mathbf{b} = -\mathbf{v} \text{ div } \mathbf{B} = 0$, (3.10)
  (eq. 3.8 ≡ law of induction,
  if $\mathbf{b} = 0$ resp. $\text{div } \mathbf{B} = 0$)!

- the current density $\mathbf{j} = -\mathbf{v} \text{ div } \mathbf{D} = -\mathbf{v}\cdot\rho_{el}$, (3.11)
  (eq. 3.9 ≡ Ampère's law,
  if $\mathbf{j}$ ≡ with $\mathbf{v}$ moving negative charge carriers
  (ρ_{el} = electric space charge density).

In addition the comparison of coefficients (3.11) delivers a useful explanation to the question, "*What is meant by the current density* **j**"? It is a space charge density ρ_{el} consisting of negative charge carriers, which moves with the velocity **v**, for instance through a conductor in the x-direction.

The current density **j** and the dual potential density **b** mathematically seen at first are nothing but alternative vectors for an abbreviated notation. While for the current density **j** the physical meaning already could be clarified from the comparison with the *law of Ampère*, the interpretation of the potential density **b** is still due:

$$\mathbf{b} = -\mathbf{v} \text{ div } \mathbf{B} \quad (= 0) \quad , \quad (3.10)$$

From the comparison of eq. 3.8 with the *law of induction* (eq.2.2) we merely infer, that according to the *Maxwell theory* that this term is assumed to be zero. But that is exactly the **Maxwell approximation** and the restriction with regard to the new and dual field approach, which takes root in Faraday.

3.3 The Maxwell approximation

Also the duality gets lost with the argument that magnetic monopoles (div **B**) in contrast to electric monopoles (div **D**) do not exist and until today could evade every proof. It has not yet been searched for the vortices dual to eddy currents, which are expressed in the neglected term.

Assuming a monopole concerns a special form of a field vortex, then immediately it is clear why the search for magnetic poles in the past had to be a dead end and their failure isn't good for a counterargument. The missing electric conductivity in a vacuum prevents current densities, eddy currents, and the formation of magnetic monopoles. Potential densities and potential-vortices however can occur. As a result, without exception, only electrically charged particles can be found in the vacuum.

Let us record: **Maxwell's field equations can directly be derived from the new dual field approach under a restrictive condition**.

Under this condition the two approaches are equivalent and with that also error free. Both follow the textbooks and can, so to speak, be the textbook opinion.

The restriction (**b** = 0) surely is meaningful and reasonable in all those cases in which the Maxwell theory is successful. It only has an effect in the domain of electrodynamics. Here usually a vector potential **A** is introduced and by means of the ***calculation of a complex dielectric constant*** a loss angle is determined. Mathematically the approach is correct and dielectric losses may be calculated.

Physically the result is extremely questionable since as a consequence of a complex ε a *complex speed of light* would result,

according to the definition: $c = 1/\sqrt{\varepsilon \cdot \mu}$ (1.3).

With that electrodynamics offends against all specifications of the textbooks, according to which c is constant and not variable and less then ever complex!

But if the result of the derivation physically is wrong, then something with the approach is wrong, therefore we ask if the fields in the dielectric perhaps have an **entirely other nature** and then **dielectric losses** perhaps are **vortex losses** of the **potential-vortex decay**?

3.4 The magnetic field as a vortex field

Is the introduction of a vector potential **A** in electrodynamics a substitute of neglecting the potential density **b**? Do two ways mathematically lead to the same result? And what about the physical relevance?
After classic electrodynamics, being dependent on working with a complex constant of material is buried an insurmountable inner contradiction.

The answer begs for the **freedom of contradictions of the new approach**. At this point the decision will be made, if physics has to make a decision for the more efficient approach, as it always has done when a change of paradigm has had to be dealt with.

The abbreviations **j** and **b** are further transformed, at first the current density in *Ampère's law*

$$\mathbf{j} = -\mathbf{v}\cdot\rho_{el} \qquad (3.12)$$

as the movement of negative electric charges.

By means of *Ohm's law* $\mathbf{j} = \sigma\cdot\mathbf{E}$ (3.13)

and the *relation of material* $\mathbf{D} = \varepsilon\cdot\mathbf{E}$ (3.14)

the *current density* $\boxed{\mathbf{j} = \mathbf{D}/\tau_1}$ (3.15)

also can be written down as dielectric displacement current with the characteristic *relaxation time constant* for the eddy currents

$$\tau_1 = \varepsilon/\sigma \qquad (3.16).$$

In this representation of the law of Ampère:

$$\boxed{\text{curl}\,\mathbf{H} = \partial\mathbf{D}/\partial t + \mathbf{D}/\tau_1 = \varepsilon\cdot(\partial\mathbf{E}/\partial t + \mathbf{E}/\tau_1)} \qquad (3.17)$$

clearly is brought to light why the magnetic field is a vortex field, and how the eddy currents produce heat losses depending on the specific electric conductivity σ. As one sees, with regard to the magnetic field description, we move around completely in the framework of textbook physics.

3.5 The derivation of the potential-vortex

Let us now consider the dual conditions. The comparison of coefficients looked at purely formal, results in a *potential density*

$$\boxed{\mathbf{b} = \mathbf{B}/\tau_2} \qquad (3.18)$$

in duality to the *current density* **j** (eq. 3.13), which with the help of an appropriate time constant τ_2 founds *vortices of the electric field.* I call these "***potential-vortices***"

$$\boxed{\text{curl}\,\mathbf{E} = -\partial\mathbf{B}/\partial t - \mathbf{B}/\tau_2 = -\mu\cdot(\partial\mathbf{H}/\partial t + \mathbf{H}/\tau_2)} \qquad (3.19)$$

In contrast to that the Maxwell theory it requires an **irrotationality of the electric field**, which is expressed by taking the potential density **b** and the divergence **B** equal to zero. The time constant τ_2 thereby tends towards infinity.

There isn't a way past the potential-vortices and the new dual approach,

1. as the new approach gets along **without a postulate**, as well as
2. consists of **accepted physical laws**,
3. why also **all error free derivations** are to be accepted,
4. no scientist can afford to already exclude a possibly **relevant phenomenon** at the approach,
5. the **Maxwell approximation** for it's negligibleness is to examine,
6. to which a **potential density measuring instrument** is necessary, which may not exist according to the Maxwell theory.

4. Consequences of the new electrodynamics

Supported by the discovery of magnetic monopoles by the Helmholtz center [4-1 Science, and others] in Berlin and Dresden we are forced to accept a div **B** different from zero which forbids the usual use of the vector potential **A** in the new physics.
In its place come the potential density **b** and the potential-vortices with the characteristic time constant τ_2. Therefore, the Maxwell approximation is history.

Nevertheless, we should check the new field approach for plausibility. At this point particularly the question of the calculation of dielectric losses in capacitors and insulators interests us.

4.1 The extended Poynting Vector

The Poynting vector $\mathbf{S} = \mathbf{E} \times \mathbf{H}$ (4.1)

stands for the energy flux density of the electromagnetic field. With this usual abbreviation the calculation of the entire energy balance is possible. First the power flux density is determined:

$$\operatorname{div} \mathbf{S} = \operatorname{div} (\mathbf{E} \times \mathbf{H}) = \mathbf{H} \cdot \operatorname{curl} \mathbf{E} - \mathbf{E} \cdot \operatorname{curl} \mathbf{H} \qquad (4.2)$$

Then the enlarged field equations are used for [3.8 or 3.19 (curl **E**) and for 3.9 or 3.17 (curl **H**)]:

$$\operatorname{div} \mathbf{S} = -\mathbf{H} \cdot d\mathbf{B}/dt - \mathbf{H} \cdot \mathbf{b} - \mathbf{E} \cdot d\mathbf{D}/dt - \mathbf{E} \cdot \mathbf{j} \qquad (4.3)$$

By consideration of the material equations and the relation, that

$$\varepsilon \cdot \int_0^{\mathbf{E}} \mathbf{E} \cdot d\mathbf{E} = \tfrac{1}{2}\varepsilon \cdot \mathbf{E}^2 \text{ resp. } \mathbf{E} \cdot d\mathbf{D}/dt = d/dt(\tfrac{1}{2}\varepsilon \cdot \mathbf{E}^2) \qquad (4.4)$$

and accordingly: $\mathbf{H} \cdot d\mathbf{B}/dt = d/dt(\tfrac{1}{2}\mu \cdot \mathbf{H}^2)$ (4.5)

the energy balance for an infinitesimal volume element (Poynting theorem) in enlarged form is:

$$\operatorname{div} \mathbf{S} + d/dt(\tfrac{1}{2}\varepsilon \cdot \mathbf{E}^2 + \tfrac{1}{2}\mu \cdot \mathbf{H}^2) + \mathbf{E} \cdot \mathbf{j} + \mathbf{H} \cdot \mathbf{b} = 0 \qquad (4.6)$$

Four of the five appearing terms in the entire balance are described and discussed in numerous textbooks [i.e. 4-2: Blume, page 68]. Thus div **S** stands for the input power, $\varepsilon \cdot \mathbf{E}^2/2$ describe the stored electric and $\mu \cdot \mathbf{H}^2/2$ the magnetic energy density, while the expression $\mathbf{E} \cdot \mathbf{j}$ explains the losses.

Thus the electric energy stored in a condenser amounts:

$$W_{el} = \iiint_V (\tfrac{1}{2}\varepsilon \cdot E^2) dV = \frac{\varepsilon\, U^2}{2\, d^2}\, d \cdot A = \frac{1}{2} U^2 \frac{\varepsilon\, A}{d} = \frac{1}{2} C \cdot U^2 \qquad (4.7)$$

with the capacity of the condenser $C = \varepsilon \cdot A/d$ (4.8)

Analogously the magnetic energy stored in an inductance amounts to:

$$W_{mag} = \iiint_V (\tfrac{1}{2}\mu \cdot H^2) dV = \frac{\mu\, I^2}{2 s^2}\, s \cdot A = \frac{1}{2} I^2 \frac{\mu\, A}{s} = \frac{1}{2} L \cdot I^2 \qquad (4.9)$$

with the inductance of a conductor loop $L = \mu \cdot A/s$ (4.10)

A certain duality between the electric and the magnetic field can't be neglected.

If the stored power is subtracted from the supplied input power only the losses are left in the energy balance. Besides, there also appear two terms of losses $\mathbf{E} \cdot \mathbf{j}$ and $\mathbf{H} \cdot \mathbf{b}$, which require a more exact investigation.

4.2 Joule effect losses in the energy balance

All textbooks about electrodynamics agree to the fact that only **one** term of loss should appear. This being the heat in an electrically conducting medium on the basis of currents or eddy-currents. For calculating the energy transformed into heat one puts the volume integral over the power density **E·j** (with the Ohm´s law $E = j/\sigma$ after eq. (3.13)):

$$P = \iiint_V E \cdot j \, dV = \iiint (j^2/\sigma) \, dV = (j^2/\sigma) \cdot A \cdot d = I^2 \cdot R \quad , \quad (4.11)$$

Because the current density j defines the current

$$I = j \cdot A \qquad (4.12)$$

and together with the specific conductance σ

the resistance R: $$R = d/\sigma \cdot A \qquad (4.13)$$

The relaxation-time constant $\tau_1 = \varepsilon/\sigma$ represents the eddy-currents and describes the vortex decay as we had mentioned in eq. 3.16. If we substitute the conductivity and attach the surface A as disks of a capacitor and d as their distance to each other (after eq. 4.8) the loss resistance gets a slightly different meaning:

$$R = \frac{d}{A \cdot \sigma} = \frac{d}{A} \frac{\tau_1}{\varepsilon} = \frac{\tau_1}{C} \qquad (4.14)$$

Thus the time constant of the eddy-currents suggests a **R-C-circuit** with the time constant

$$\tau_1 = R \cdot C \qquad (4.15)$$

One might calculate the loss factor of a capacitor run on alternating currents in this manner [4-3 Flügge, p.135]

$$\tan \delta = 1/\omega \cdot R \cdot C \qquad (4.16)$$

but what remains unnoticed is the fact that here exclusively the *Joule effect* is calculated, while an electric conductivity σ forms the basic condition for the realization of the currents and eddy-currents.

A good insulator does not fulfill this basic condition any better than standard capacitors. And this is only one **point of critique** among many.

If we run the capacitor, for example with AC currents and exchange the dielectric with one of less conductivity, then the time constant will grow and also the losses are supposed to grow to infinity. This is nonsense!

A derivation which still works fine in the case of conducting materials is completely useless for calculating dielectric losses. In formular and application books show the measured loss factors listed as a substitute for the offered model and have a limited validity as they only work as guidelines [4-4: e.g. Küpfmüller, p.157].

Of course there is always a complex ε and the implied offence against the constancy of the speed of light hidden behind these loss factors! Thus one mistake causes the other. In the end the whole electrodynamics subject is under heavy critique. Fortunately, there is a solution to all our problems, as the extended *Poynting vector* (4.6) offers a **new loss term** in addition to the known ones.

4.3 Potential-vortex losses in the energy balance

The potential density **b**, introduced in the Maxwell equations stands for the origin of potential-vortices like they are expected to be found in poorly conducting materials and particularly in capacitors and insulators. In contrast to eddy-currents with their "*skin effect*" the potential-vortices move towards the *vortex center* to decay there and to generate *heat.*

Again we calculate the power by using the volume integral over the power density **H·b** (in eq. 4.3);
(with $H = B/\mu = b\cdot\tau_2/\mu$ after eq. (3.18)):

$$P = \iiint_V H\cdot b\, dV = \iiint (b^2\tau_2/\mu)\, dV = (b^2\tau_2/\mu)\cdot A\cdot s$$
$$= b^2\cdot A^2\cdot\tau_2\cdot s/\mu\cdot A = U^2\cdot\tau_2/L = U^2/R_2\,, \qquad (4.17)$$

because the *potential-density* b gives the voltage

$$U = b\cdot A \qquad (4.18)$$

and the inductivity of a conductor loop L is given by equation 4.10.

The *time constant* τ_2 being responsible for **heat generation by vortex decay of the potential-vortices** suggests an R-L-behavior:

$$\tau_2 = L/R_2 \qquad (4.19)$$

whereas the parameters R_2 and L are also in this case to be understood as parameters of an alternitive model. However, this time the resistance is in the denominator which corresponds to reality even better. If we converted this into current losses with R (after eq. 4.13) for better comparability:

$$R_2 = \frac{\mu\cdot A}{\tau_2\cdot s}\cdot\frac{\sigma}{\sigma} = \frac{\mu}{\tau_2\cdot\sigma\cdot R} = \frac{\tau_1}{\tau_2}\cdot\mu^2\cdot\frac{1}{R}\,, \qquad (4.20)$$

then the losses ascertained in textbooks would have to be corrected according to the time constants τ_2/τ_1 (i.e. for the purposes of the potential-vortices in the dielectric and to the loads of the counter-rotating eddy-currents).

However, the actual efficiency of the new approach only shows when calculating a concrete case. When looking through technical literature, take Prof. **Simonyi** as an example [4-5, p.698]. Simonyi first calculates the special case of a frame antenna as a current loop by the harmlessly wrong assumption of a *vector potential* **A**.

The mathematically won result for the emitted power is very similar to that of a dipole antenna. This makes Simonyi understand his loop as a magnetic dipole and create the duality to the electric dipole. He writes, "*We can imagine it like this: just as there are electric charges flowing in an electric dipole there are virtual magnetic currents flowing in the form of virtual magnetic charges here.*"

In this explanation the lack of duality is to be taken into account because a current is never dual to a current! The variable dual to the current density **j** is the *potential density* **b**, which Simonyi calls *magnetic current density* $\mathbf{j}_m$.

Mathematically, the new approach fits perfectly, according to Simonyi, "*The magnetic loads introduced here are of course virtual, however, the radiation field can be calculated as if they were real.*" Furthermore, he calls the introduction of $\mathbf{j}_m$ (= **b**) suitable, "*because one can thereby convert more complicated radiation fields back to the known dipole fields.*"

4.4 Erroneous Proca equations

Simonyi certifies the mathematical applicability to the new approach and, in addition, points to its superiority compared to the outdated approach. But with his view he remains a special physicist among the electrodynamicists who all still calculate with **B** = 0 and with the vector potential **A** whereas the approach is used

$$\mathbf{B} = \text{curl}\ \mathbf{A} \qquad (4.21).$$

This approach is not allowed anymore due to the **discovery of magnetic monopoles in 2009**. At the same time all attempts to insert the vector potential into the Maxwell equations are to be cancelled. These are known as *Proca equations* [4-6: Lehner, p.521].

These equations clearly indicate the contradictions of the old or *classical electrodynamics*. If one sets the electric conductivity close to zero, all the additional terms disappear and the *Maxwell equations* are left. The failure is hardwired if it is about the calculation of insulators.

Also, in the case of the *Proca equations* taking another look for the *Poynting theorem*, the energy balance does not deliver any additional loss term with which the *dielectric losses* could be explained.

This extension is somewhat helpful, although we agree that an extension is necessary in the Maxwell equations. However, this has to occur mathematically and has to be physically correct.

For the rehabilitation of the *Proca equations* it should be mentioned that in isolated cases the extension by potential also generate correct results. Thus *Lehner*

derives ***longitudinal waves*** [4-6, page 528], which I call "***scalar waves***" [4.7].
However, he limits his result by pointing out the fact that there are no "*longitudinal waves of this form in the classical theory. They are only possible if space charges exist.*" Hence he limits the validity of his derivation to the special case of a ***plasma wave***.

The general derivation of *scalar waves*, proven already 100 years ago by **Nikola Tesla** experimentally and still existing today within every **near field of an antenna**, is found in my book "*Scalar wave transponder*" [4-7 Meyl, p.39]. With which instead of the *vector potential* **A** the *potential density* **b** is used.

In direct comparison, the results once more confirm that several ways can lead to the aim but that an extension is however, necessary in any case. In the question which expansion is to be recommended everything points at the potential density **b** - not only because of broader validity of the *calculated scalar waves* but also the possibility of a correct *calculation of losses* within capacitors and microwave ovens.

> The discovery of the *potential-vortices* and the *new approach* lead far beyond it to a unified world of physics and a big unification of all interactions and the removal of all unsettled physical constants [5-1 Meyl: Material collection].

5. Objectivity of interactions

The quantization of nature asks for a phenomenon capable of building a structure. The potential-vortex has exactly this quality due to its contraction effect. Therewith it exerts a pressure from all directions and forms known structures. The most frequent structure is a ball.

Possibly it had been a big mistake to zero the structuralizing potential-vortices in the field theory. As a result this negatively affects all chapters of physics leading to postulates and distorted images.

5.1 Vortices in micro and macrocosm

For a limited structure it is also necessary to have an expending vortex inside working against the force of the contracting vortex from the outside.

Examples:	*expanding vortex*	*contracting vortex*
• quantum physics	*collision processes (several quarks)*	*gluons (postulate!)*
• nuclear physics	*repulsion of like charged particles*	*strong interaction (postulate!)*
• atomic-physics	*centrifugal force of the enveloping electrons*	*electrical attraction, Schrödinger equation*
• classical mechanics	*centrifugal force (inertia)*	*gravitation (can not be derived?!)*
• astro physics	*inertia of the stars at galaxy rotation*	*cohesion of the galaxies (Strings, dark matter?)*

Let's consider some examples and thereby search for the expanding and contracting forces.

- In quantum physics one imagines the elementary particles to be consisting of quarks. Irrespective of the question, which physical reality should be attributed to this model concept, one thing remains puzzling: The quarks should run apart, or you should try to keep together three globules which are moving violently and permanently hitting each other. For this reason glue particles were postulated, the so-called gluons, which now should take care for the reaction force, however this reaction force is nothing but a postulate!
- In nuclear physics it concerns the force which holds together the atomic nucleus, which is composed of many nucleons, and gives it the well-known great stability. Although here like charged particles are close together, particles which usually repel each other. Between the theoretical model and practical reality there is an enormous gap, which should be overcome by introducing a new reaction force. But also the nuclear force, called strong interaction, is nothing but a postulate!
- In atomic physics the electric force of attraction between the positive nuclear charge and the negatively charged enveloping electrons counteracts centrifugal force. In this case, the anti-vortex takes care for a certain structure of the atomic hull which obeys the Schrödinger equation as eigenvalue solutions. But this equation irrespective of its efficiency, until today, is purely a mathematical postulate as long as its origin is not clear.

- In Newtons mechanics centrifugal force (expansion) as a result of the inertia and gravitation (contraction) and as a result of the attraction of masses are balanced. But the *„gravitation"* puts itself in the way of every attempt to formulate a unified field theory. Also this time, it is the contracting vortex of which is said *can't be derived nor integrated.*

- In astrophysics we direct our view to an unknown galaxy, then does it rotate around its centre and in doing so to a large extent keeps its form? Despite rotation of its own an elliptic, a barred or even a spiral galaxy virtually doesn't change its characteristic form. *From this follows that the inner stars of a galaxy are considerably slower on their way than the outer stars!* But we expected exactly the opposite.

According to *Kepler's regularity* the outermost stars would have to orbit extremely slow in order not to be hurled into space as a result of the centrifugal force. But then a galaxy wouldn't keep its structure. The spiral form, as it already has been observed and classified by **Hubble**, merely would be an accidental exception as a momentary picture, by no means the rule.
We have to take note, that the structure and in particular the cohesion of a galaxy can't be explained with *Kepler's laws.*
[*The basic laws of the universe start to rock: "What is the matter with the galaxies? They rotate in their fringe ranges much faster, as is allowed by the laws of physics. Or is something wrong with these venerable laws? The astronomers and physicists stand for the dilemma to have to decide between the two alternatives: feign the observations us another world or do we calculate wrong since centuries?"*
translated from *„Bild der Wissenschaft"* Nr. 2, 1989]

It is remarkable how in the domain of the contracting vortex the postulates are accumulating. But this hasn't always been the case. In ancient Greece, 2400 years ago, Demokrit undertook an attempt to formulate a unified physics. He traced all visible and observable structures in nature back to vortices, each time forming of vortex and anti-vortex. This phenomenon appeared him to be so fundamental that he put the term *"vortex"* equal to the term for *"law of nature"*. The term *"atom"* stems from Demokrit (460-370 BC).

Seen this way the physicists in ancient times already had been further along the today's physics, which with the Maxwell approximation neglects the contracting vortex and excludes fundamental phenomena from the field description, or is forced to replace them by model descriptions and numerous postulates.

What we need is a new field approach, which removes this flaw and in this point reaches over and above the Maxwell theory. It is still found with the *Equations of transformation* (2.1 and 2.3).

The new and field-theoretical approach contains the Maxwell-equations indeed, but goes over and above these in one point. It describes ***potential-vortices*** and their propagation in space as a ***scalar wave***. With that can a conclusive answer be given to the often-asked question for the medium and the mediated particles, which is a prerequisite for every ***longitudinal wave*** ? Mediated are **vortex structures** with particle nature and the field itself functions as a medium. Does that also answer the question concerning the aether?

5.2 The aether question

Do you know the Maxwell-experiment? No, you wouldn't be able to, since the intellectual father quickly retracted the experiment after it didn't work out. Today one speaks of the **Michelson-experiment** and it may be connected with any other names (Morley, etc.).
In his light theory **Maxwell** had determined a particular and constant value for the speed of light and for that there should be a physical reason, which should have its cause in the aether. By means of proving this aether Maxwell wanted to prove his theory, but this enterprise thoroughly went wrong.

The consideration was as follows: If the Earth is spinning and is moving through the cosmos, then one should be able to detect an aetherwind and different values for c in the different points of the compass.
Maxwell found support for his project in Berlin (Germany) at the observatory, since with the aberration of the stars, **Bradley** previously had described an observation, which could be considered as evidence for an aether. The director of the observatory charged his assistant **Dr. Michelson** with the task to carry out a corresponding proof of an aether this time in a terrestrial experiment. But such an aether couldn't be proven, and so Maxwell had to accept as a severe strike against his *light theory*.
Seven years later **Maxwell** got the acknowledgement, from a completely other corner through the experiments concerning the radio transmission of **Heinrich Hertz**.

Until today the question has remained open why astrophysics can prove the aether, whereas the detection in a terrestrial laboratory fails to confirm that an aether exists.

But as definition for the cause of c the aether can't be abolished as long as it is unsettled why the light is propagating with c of all possible velocities. The question then is asked, "*What determines the propagation of light from today's point of view?*" Now, by means of outside fields the light can be slowed down. At present the world record lies at less than 65 kilometers per hour in a ***Bose-Einstein condensate***. If electromagnetic fields determine the speed of light, if in addition field or gravitational lenses should confirm this, then the field takes over the task of the aether!

At this point the new field-theoretical approach shows its capabilities. The equations of transformation say that a moving H-field transforms to a resting E-field and vice versa, that thus in the place of a moving aether the aetherwind, a resting aether is found. Doing so the dual field partners merely exchange places. Therefore, it is a wild-goose chase wanting to measure an aetherwind with gauges which underlie the same field. *Michelson had to fail.*

5.3 Transformation equations of the EM-Field

Until now the question concerning the aether could not be solved with any existing approach. Only the new field-theoretical approach proves the unambiguous and free of contradiction clarification of the question concerning the aether. We hence, without exception, work with this approach which is anchored tightly in textbook physics, free from postulates and with unmatched superiority.
The two equations of transformation on the one hand are the law concerning the unipolar induction according to Faraday (2.1) and on the other hand the dual

formulation (2.3), which **Grimsehl** calls ***convection equation*** [5-2, S.130]. Grimsehl goes around the question for the correct sign by means of forming a modulus. **Pohl** draws detailed distinctions of cases and dictates the each time relevant formulation of the dual law [5-3, S.72, 76, 130]. The sign eventually should be chosen according to the definition of the orientation of the field pointers.
Also **Simonyi** gives both equations and the each time appropriate experiments [5-4, page 924].

$$\boxed{\mathbf{E} = \mathbf{v} \times \mathbf{B}} \quad (2.1) \text{ and } \quad \boxed{\mathbf{H} = -\mathbf{v} \times \mathbf{D}} \quad (2.3)$$

with: $\mathbf{B} = \mu \cdot \mathbf{H}$ (5.1) and $\mathbf{D} = \varepsilon \cdot \mathbf{E}$ (5.2)

$$\boxed{\mathbf{E} = \mu \cdot \mathbf{v} \times \mathbf{H}} \quad (5.3) \text{ and } \quad \boxed{\mathbf{H} = -\varepsilon\, \mathbf{v} \times \mathbf{E}} \quad (5.4)$$

If we assume the carrier of an electric field is moving with the not accelerated relative velocity **v** with regard to the reference system used by the observer, then a magnetic **H**-field is observed, which stands perpendicular both to the direction of the **E**-field and to the direction of **v**. If the motion takes place perpendicular to the area stretched by **E**- and **H**-field, then the **H**-field again is observed and measured as an **E**-field. There will occur an overlap of the fields.
Equation 5.4 inserted in Equation 5.3 by using the definition for the speed of light:
give the result:

$$\varepsilon \cdot \mu = 1/c^2 \quad (1.3)$$

$$\mathbf{E} = -\varepsilon \cdot \mu \cdot [\mathbf{v} \times (\mathbf{v} \times \mathbf{E})] \quad (5.5)$$

$$\mathbf{E} = -(1/c^2) \cdot [\underbrace{\mathbf{v} \cdot (\mathbf{v} \cdot \mathbf{E})}_{= 0,\ \text{da} \perp} - \mathbf{E} \cdot (\mathbf{v} \cdot \mathbf{v})] \quad (5.6)$$

$$\mathbf{E} = +(\mathbf{v}^2/c^2) \cdot \mathbf{E} \quad (5.7)$$

We first consider the theoretical case that no overlap is present and that the observer, as it were, sees himself. The result is trivial: the relative velocity v must be the speed of light c

$$v = c. \quad (5.8)$$

If considered at the speed of light, the two equations of transformation turn into each other. They now are identical both mathematically and in their physical expressiveness. For this case it actually is possible, to derive the dual law (2.3) straight from the *Faraday law* (2.1). For a wave propagating with the speed of light, to name an example, the field strength propagating along is always equal to the causing field strength, which depends on position.

If besides the evaluation of the values also the circumstance is considered that it concerns vectors, then at this place a problem as a matter of principle of the Maxwell theory becomes visible, which has been pointed occasionally, i.e. at the German Physical Society [5-5, DPG, S. 396].

The derivation of the speed of light from two vector equations requires, that c also has to be a vector. The questions are *"How the velocity vector **v** suddenly becomes the scalar and not pointing in all directions of space a constant factor c? Is therefore, for mathematical and physical reasons the Maxwell theory in essential parts are erroneous, according to a statement of the German Patent Office?"*

The constancy of the speed of light is a fact which can be derived. We at first will be content with the clue that for every observation with the speed of light, with the eyes or a gauge constructed corresponding to our perception, the vector in all its components each time is

correlated to itself, and that actually the orientation of direction gets lost. Under these for c and with equal rights also for v relevant circumstances we are entitled to calculate further with these values.

5.4 Vortices – an overlapping of the overlapping

An observer, who is moving with v slower than c, will besides the original E-field also observe a motion field E_v depending on the velocity v, which disappears, if v becomes zero.

$$E_v = (v^2/c^2)\cdot E_0$$

and $$E_v\,(v = 0) = 0 \qquad (5.9)$$

What he catches sight of and is able to register with gauges in the end is the overlap of both field components.

But it doesn't abide by this one overlap. In the case of vortex fields the effect overlaps the cause and itself becomes the cause for a new effect. The overlapped cause produces a further effect, which for its part is overlapping.
Vortices thus arise if overlaps for their part are overlapping and that theoretically reach to infinity. In addition, we ask "*do vortices represent a fundamental physical principle*?" The Greek philosopher **Demokrit** has traced back the whole nature to vortex formation and that was 2500 years ago!

In the field-theoretical approach this interpretation seems to experience a mathematical confirmation since also the fields are overlapping in vortex structures.

According to that we owe our observations and our being so the relative movements and the vortex formation. If reversed there wouldn't be any movement, fields, light or matter and as a result would not exist. If we observe the sky, then everything visible follows the movement of the Earth, of the solar system and the whole galaxy, which is moving with unknown galactic velocity, and all movements take place in vortex structures.

- The field E_0 overlaps the motion field E_v

$$E = E_0 + E_v = E_0\cdot(1 + v^2/c^2) \qquad (5.10)$$

This overlapping may be traced back to our approach 5.3 and 5.4:

$$E = E_0 + \mathbf{v} \times \mathbf{B} \qquad (5.11)$$

Alternatively we could have taken eq. 5.11 from several textbooks [5-4, S.924], disclaiming the derivation.

- For infinite overlap:

$$E = E_0 + E_1 + E_2 + E_3 + E_4 + \ldots + E_n + E_{n+1} + \ldots \qquad (5.12)$$

- with $$E_{n+1} = E_n\cdot(v^2/c^2) \qquad (5.13)$$

- results in the power series, which converges under the condition that $v < c$,

or: $$q = (v^2/c^2) < 1 \qquad (5.14)$$

$$E = E_0\cdot[1 + (v/c)^2 + (v/c)^4 + (v/c)^6 + \ldots + (v/c)^{2n} + (v/c)^{2(n+1)} + \ldots] \qquad (5.15)$$

$$E = E_0\cdot[1 + q + q^2 + q^3 + q^4 + \ldots] = 1/1\text{-}q \qquad (5.16)$$

As a result of the power series development the well-known square root $\sqrt{1-(v^2/c^2)}$ of **Lorentz** occurs in squared form. It determines the relation of the observed and the causing field strength of the electric or the magnetic field (analogue derivation).

$$\boxed{(1-\frac{v^2}{c^2}) = \frac{E_0}{E}} \quad \boxed{(1-\frac{v^2}{c^2}) = \frac{H_0}{H}} \qquad (5.17)$$

5.5 Lorentz-contraction and dilatation field

Physically the found relation describes a dilatation field depending on velocity. The field strength thus increases, if the relative velocity v increases, or inversely no difference is observable anymore, if v tends towards zero.
If we compare this in a purely mathematical way with the *length contraction* of the *Lorentz transformation*,

$$1-\frac{v^2}{c^2} = (\frac{1}{l_0})^2 \qquad (5.18)$$

then it becomes clear that the *Lorentz contraction*, physically seen, should have its cause in the changed field conditions which a relativistic speed moving body finds with regard to a resting body.

$$1-\frac{v^2}{c^2} = \frac{E_0}{E} = \frac{H_0}{H} = (\frac{1}{l_0})^2 \qquad (5.19)$$

In our observer system, where the field E_0 exists, a rule has its proper length l_0. In another system, which is moving with the speed v relative to the observer, as a consequence of the prevailing field E the corresponding rule has a length l. Equation 5.19 gives the relation between both eq. 5.17 and 5.18.

Accordingly the following proportionality holds:

$$\boxed{E, H \sim 1/l^2} \quad \text{and} \quad \boxed{E_0, H_0 \sim 1/l_0^2} \qquad (5.20)$$

The field determines the dimensions!

The resulting proportionality is of most elementary importance. We use it in the case of the piezo speaker and know it from the curvature of space and deflection of light in the presence of extreme fields. If we are exposed to the field as an observer in which also the object observed is situated then we are in the dilemma of not being able to perceive the influence. If we, for example would sit in a rocket we would become smaller at faster velocity, and we would notice nothing since we also would shrink to the same extent.

That concerns every measurement of velocity in general and the speed of light c in particular which is measured in *meters per second*. But if the field determines c and in the same way the length measure, which is given in *meters*, then both stand in a direct proportionality to each other, and we won't have the slightest chance to measure the speed of light. If c is changed, then this concerns the measurement path in the same way. Now the variable is measured with itself and as a result appears c, a constant value. We still can not see the change since our eyes scan all objects optically and that means with the speed of light c.

5.6 c becomes a measuring constant

It is the nightmare of each and every measurement engineer if the gauge depends on the factor to be measured. No wonder, the theorem of addition of velocities apparently loses its validity as always the same c is being measured independent of the direction in which the source of radiation is moving [5-1, Meyl p. 115]. The result is:

The speed of light is a constant of measurement and not a constant of nature!

If, however, the light is scanned with the speed of light, then all components of the light vector correlated with themselves resulting in the same constant value c, then the vector of the speed of light loses its orientation in space and becomes a scalar factor.

The Maxwell equations already anticipate this circumstance, but without providing an explanation why this is correct. Only the new field approach can answer the open question. With the derivation an axiom of physics – one also can say stumbling block – has been overcome.

The scientist who has a good idea will very often find that some other scientist has had the same idea previously, and this scientist as well did make the same experience before. Is it possible, that discoverers in reality only are rediscoverers of a much older knowledge?

5.7 Boscovic and the respiration of the earth

The dependence of the length measures on the field (eq. 5.20) in the mathematical form of the derivation, however should still be quite new. But the physical consequence already was described by the Jesuit priest **Roger Joseph Boscovic** from Dalmatia in 1755 [5-6]. Boscovic was a Professor of mathematics and theology in Rome and spoke about the world on the one hand being deformable, similar to rubber, but on the other hand we aren't able to perceive this since our body is made of the same material and follows all changes. „*We in an absolute way can recognize neither the place, nor distances, or orders of magnitude*", writes Boscovic in his book about "*space and time*" and how these are perceived by us. He suspects that the Earth, unobservable for man, "*is respiring*".

Actually a terrestrial observer in daytime is situated closer to the sun than at night. By day he is exposed to a slightly stronger field and as a result is correspondingly smaller. He himself and all objects in his neighborhood are subject to an identical fluctuation of size, so that this "*respiration*" of the Earth cannot be detected. It can not be detected with a tape measure or with an optical measurement and still be present in reality. Only from a neutral standpoint can we succeed in recognizing the actually existing curvature of space (fig. 10).

An example is the duration of the sunshine at the equator which is longer than can be expected from the spherical form of the Earth. This reveals how the Earth is bending towards the sun [5-1, S. 107].

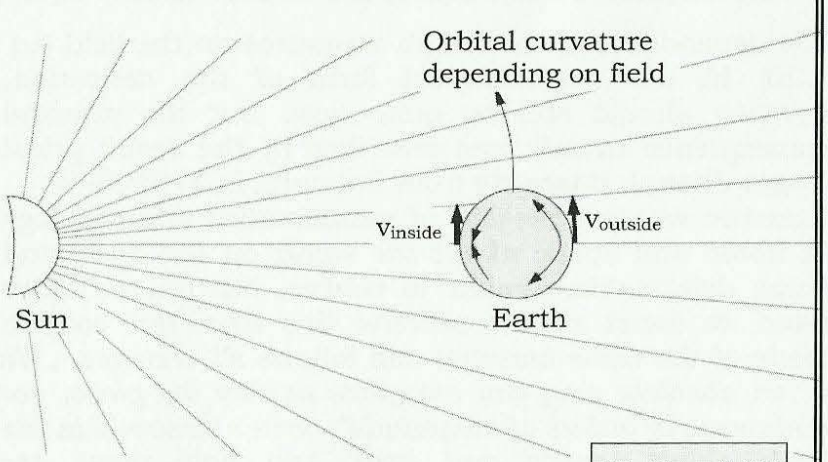


Fig. 10: The curvature of the Earth in the gravitational field of the sun

A further example is the influence of the field on the orbital velocity of the Earth measured in meters per second. Here the meters in the daytime are smaller than in the night. For this reason the Earth is moving slower on the side turned towards the sun, like a track vehicle which drives a turn. If the chain on the inside of the tracks runs slower than on the outside the vehicle turns.

If the Earth describes an orbit around the sun, then this circumstance has to do nothing at all with centrifugal force or with a force of attraction of the sun. The **circular motion** simply and solely is a **result of the field influence of the sun.**

5.8 Derivation of gravity

The force idea proves to be a pure auxiliary description. In the context of Newtonian mechanics the force plays a central role. Without question it is a very efficient and subjective perceptible description which still isn't able to reproduce the physical reality in an objective manner.

What keeps the planets in their orbit is only the field of the sun, which we call the gravitational field, and not some force! But of which kind is the gravitation and the field which causes masses to come closer together and, following our subjective observation, attract each other.

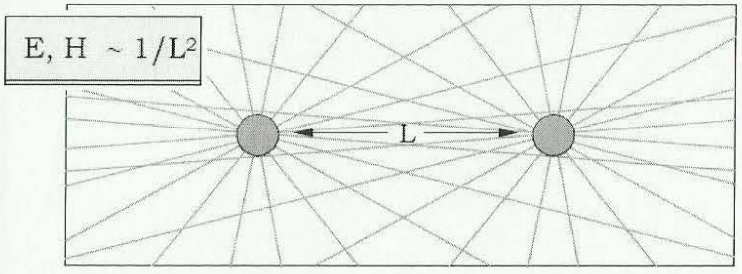


Fig. 11: Force of attraction and reduction of the distance L as the mutual field influence of two masses.

In Fig. 11 the relation between the field influence and the observed force of attraction of two mass bodies is represented. If I, in my mind, "*switch on*" the field lines of both bodies which are placed at distance L, then the fields according to equation 5.20 reduce the measure L and optically come closer together. With increasing proximity the field line density increases so that L further decreases. We observe a mutual attraction which lets both bodies move towards each other.

5.9 Electromagnetic interaction

In fig. 12 the two bodies carry an electric charge. For different polarity the field lines is well-known for running from the positive pole to the negative pole, to bundle up there. As a matter of principle it is where an attraction can be expected, which is called electromagnetic interaction. For the reason of the bundling up of the field lines this effect will turn out to be considerably stronger. Hence, the electromagnetic interaction is many powers of ten more powerful than the gravitation.

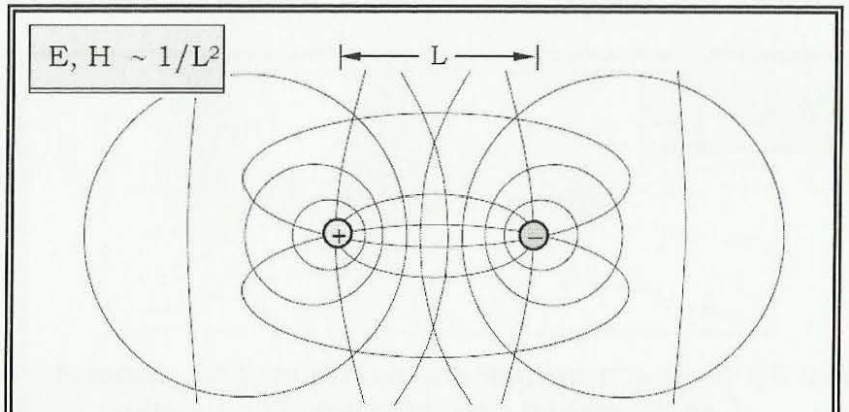


Fig. 12: Electromagnetic interaction as a result of the mutual influence of open field lines.

Furthermore, there can occur repulsion if in the case of like charge the field lines are bent aside and between the two bodies an area is formed where the field tends towards zero and the distance measure L (according to eq. 5.20) as a result towards infinity. The electromagnetic interaction theoretically reaches to infinity. Responsible are the open field lines arising from a charged body.

5.10 Importance of the closed vortex-lines

Now every charged body in addition has a mass with which it takes part in the gravitation. Let's remember the comparison of the derivations. The Maxwell theory teaches us that in the static case E- and H-fields are decoupled each time the other field disappears. Even if, as a result of the unipolar induction for every open field line, the other one is taken to be standing perpendicular to the open field line then this other line just wraps around the open field line and forms a closed-loop field line. In that way it can't be influenced anymore from the outside and can be neglected, so goes the doctrine, which is drawn from the Maxwell theory.

This is a fatal error in reasoning! The equation 5.20 naturally is valid for open field lines in the same manner as for closed ones. These fields also lead to an observable force of attraction.

If exactly those fields are neglected, which are responsible for the gravitation, then we need not wonder, if we don't understand the gravitation and the nature of this interaction!

The influence of the closed field lines responsible for the gravitation is due to the missing bundling up of the correspondingly weak lines. Secondly, there can't exist a force of repulsion due to the missing ability to influence closed field lines from the outside. And thirdly, it can be recorded that all charged bodies also have a mass. All three statements of the field lines model perfectly cover the physical reality.

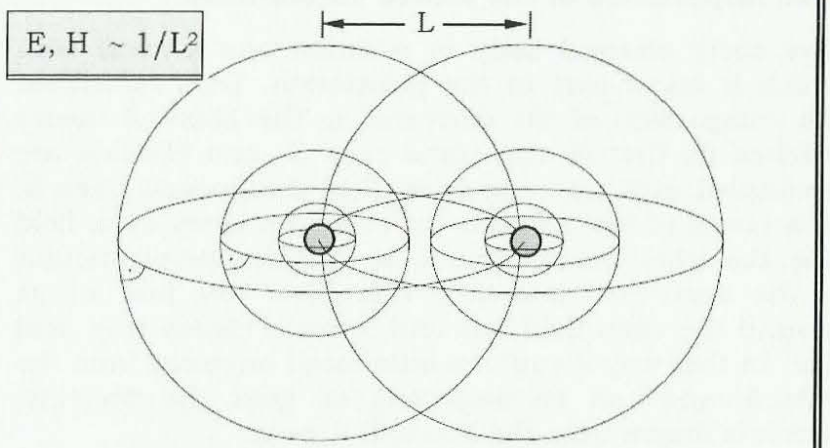


Fig. 13: Gravitation as a result of the mutual influence of the closed field lines (vortex-lines)

Fig. 13 shows uncharged bodies for which both the field lines of the E-field and of the perpendicular to them arranged H-field are closed-loop. Such bodies (i.e. neutrons or whole atoms), without charge behave electrically neutral to the outside but have a mass for the reason of the closed field lines, whereby the field lines of the H-field dominate those of the E-field.

With the field lines interpretation, which by the way already preferably was used by Faraday, the gravitation proves to be, until now, neglected influence of the electromagnetic field. For the first time the grand unification of the interactions was successful. The long sought-for ***unified theory*** for the first time comes within reach.

6. Objectivity versus Relativity

The derivation has made it possible to mathematically secure the theoretical working model of Boscovic. In 1755 **Boscovic** points out the optical deception, which our observation underlies, if absolute orders of magnitude in our neighborhood should change and our perception would change also. Then also all metric and optical measurement results would underlie this change.

Fig. 14: The banknote from Croatia shows the Jesuit priest and as well founder of the modern Field theory Ruder Boscovic (1711-1787).

6.1 From subjectivity to objectivity

Following the idea of Boscovic, I distinguish below between subjectivity and objectivity.

• The following physical standpoints can be distinguished:		
subjectivity (laboratory physics, observable)	**relativity** (mediator role) (transformation)	**objectivity** (not observable)
• Exemplary theories and their representatives:		
Newton Maxwell	Poincaré Einstein	Boscovic *(Meyl)*
• With the associated transformation:		
Galilei-transf. at $c = \infty$	Lorentz-transf. c = constant	*(Meyl-transf.)* c = variable

Fig. 15: Physical standpoints

The ***relativity*** is a compromise lying between both points of view where a neutral standpoint is strived for, and which lies outside the events. And from this standpoint the objectively taking place and events are being observed. The theory of relativity consequently is a pure observer theory with strongly restricted scope on the basis of the Lorentz-transformation.

Theories of classic physics (i.e. Newtonian mechanics), fall in the domain of ***subjectivity***. The results and regularities are won in a terrestrial laboratory, if possible, isolated from the environment where they have absolute validity. Here the **Galilei-transformation** is valid.
But if these subjectively won laws are applied to the microcosm in quantum physics or to the calculation of cosmic observations one fast hits limits. The better the resolution of the microscopes and telescopes the clearer the "*outside*" observer realizes how much the laws of classic physics loses their validity.

Astrophysics successfully reaches for the ***theory of relativity***, which with the curvature of space in the vicinity of mass centers delivers useful explanations. Here the dependence of the spatial dimensions on the field already could be established. In contradiction to this fundamental relation it is said to play no role whatsoever in quantum physics or in all terrestrial laboratory experiments. But with what right may physical regularities from one domain be ignored in others? There can only exist one physics and that should be sought for!

What we need is ***objectivity***! Behind all the apparently disconnected phenomena of physics work lay quite simple laws which can't be observed and are until now not recognized by us. Objective physics in the words of Goethe is, "*the one which holds the world together in the heart of hearts*". I call this, already by Boscovich suggested point of view, ***theory of objectivity***. The access to the model domain of objectivity must be made mathematically by means of a transformation since it is blocked for us by means of measurements or observations [5-1, S. 123-133]. The transformation back

into the observation domain must be made according to the same mathematical relations

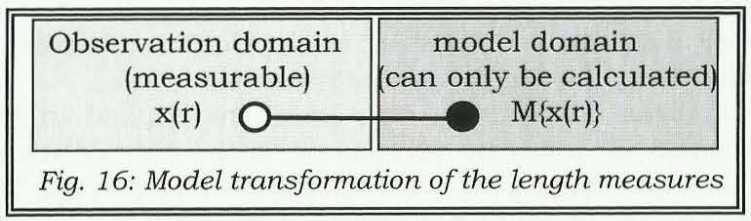


Fig. 16: Model transformation of the length measures

In this way the quantum properties of the elementary particles can be calculated with high accuracy and agreement with the values which until now could only be measured [5-1, Kap.7].

6.2 The objective point of view

The question is asked, "*how one gets to an objective physical standpoint, which evades every observation*?" The answer leads over a transformation to which all perceptible and measurable relations must be submitted.
If we for instance measure the distance r to a point light source and then the propagation of the light c and the propagation time t determine the distance measure r:

$$r = c \cdot t \qquad (6.1)$$

If there occurs a little change of the distance Δr,

$$\Delta r \approx dr = c \cdot dt + t \cdot dc \qquad (6.2)$$

then two causes should be considered: Either the propagation time or the speed of light have changed. With that the two possible standpoints already would have been found.

The ***relativistic point of view***, which proceeds from the assumption of the speed of light being constant (dc = 0), says: the propagation time (dt or Δt) varies

$$dr = c \cdot dt \qquad \text{or} \qquad \Delta r = c \cdot \Delta t \qquad (6.3)$$

and we are dealing with a clock problem. For relativistic velocities a length contraction occurs then from that necessarily follows a time dilatation.

But actually no specific statement can be made about the constancy of the speed of light, besides what we can observe, measure, and scan, everything with c. Hence we can only observe the constancy. With that the theory of relativity remains a pure observer theory, exactly as **Albert Einstein** originally called it into existence. This standpoint follows the motto "*What can't be observed doesn't need to interest the physicist*".

The ***objective standpoint*** strives for more, for a description of the processes actually taking place. This time we proceed from the assumption of a universal and constant time (dt = 0) with the argument, "*The time measure is an immutable definition and the physicist, who dictates this he himself determines what is simultaneousness*". Then there is no place for time travel and for clocks going wrong.
Therefore the speed of light can take all possible values (dc or Δc)

$$dr = t \cdot dc \qquad \text{or} \qquad \Delta r = t \cdot \Delta c \qquad (6.4)$$

always in strict proportionality to the length measures. Thus the measured length and distance measures should be transformed and that in the end is the unit "*meter*", which should be replaced by an objective measure.

With that the necessary ***transformation for variable c*** would be outlined. This transformation will be enqueued in the file of the big transformations. From it the ***Lorentz-transformation for c = constant*** emerges as a special case, like the transformation the ***Galilei-transformation*** follows ***for c = ∞***.

How should the relation of the subjective to the objective "*meter*" be determined. - By means of the relation of the relevant fields (eq. 5.20) or by means of the square root of Lorentz (eq. 28.16). We have already successfully gone through it in a concrete example [see 5-1, Chapter 7].

6.3 General and special theory of relativity

Albert Einstein distinguishes between general and special theory of relativity. Whereas the special (SRT), still is linked tightly with the prerequisites of the Lorentz-transformation, the general (GRT), deals with an extension to arbitrary systems which mustn't be inertial systems. I would like not to dwell upon the GRT, as Einstein designed it, and merely note that every generalization represents a possible source of errors and has to be well founded.

In the case of our derivation, the general case as it were resulted of its own accord. Let's turn back: If the root of Lorentz still was a component of the derived field dilatation (5.17) and equally of the length contraction (5.18), then it fell out in the comparison of both results (5.19). With that the important result, the proportionality (5.20), which among others results in the gravitation, becomes independent of the speed of light and the relative velocity v. This last step is obvious and yet still completely new.

It cannot be found by looking to Einstein, who in another way found his GRT and his description of the gravitation.
Even when striveing for the same goal deviations in the results cannot be excluded because of the differences in the derivation. For this reason I additionally mark the derived general relativity by me (GRT') to avoid confusion.

Let's speak again about the difference to the special relativity (SRT). This deals with the one-dimensional case of the uniform motion of a reference system in x-direction ($\mathbf{v} = v_x$), as specified by the Lorentz-transformation where only the x-components and not those in y- or z-direction are being transformed.
As already mentioned this is a purely theoretical case, which in practice occurs next to never. Normal is circular, and vortical, and with accelerated motion where the velocity component permanently changes its direction.

The derived result of the general relativity (GRT') does justice to this circumstance. Even if this at first only has been derived for the x-direction it nevertheless is valid equally in y- and z-direction. It even remains valid for the case that we base on a path of arbitrary form of a spatial field vortex. In this case some components continually occur in all directions of space so that the **relative velocity v just as the speed of light c loses its vectorial nature**. With that the transition of the SRT to the GRT is carried out.

By means of the spatial swirling the electric and magnetic field pointers at the same time turn into scalar factors by taking over the function of the aether. Let us remember that even Einstein in his GRT was forced to

again introduce the aether, which in the SRT still was unnecessary.

It therefore makes a difference in the transformation of physical factors if we base on a one-dimensional (SRT) or a three-dimensional spatial description (GRT). Length measures in x-direction in both cases must be converted using the root of Lorentz. Usually the relativistic γ-factor is introduced, which is inverse to the **root of Lorentz**

$$\gamma = 1/\sqrt{1-v^2/c^2}) \quad \text{with} \quad x_o/x = \gamma \qquad (6.5)$$

If individual length measures would be subject to a length contraction following the γ-factor, then a volume V according to the SRT, must be transformed with γ, according to the GRT' however with γ^3.

It is well-known a relativistic increase in mass is converted with the γ-factor and in the same manner to that proportional energy

$$E = m\,c^2.$$

However if we correlate the energy to the volume V and in that way determine an energy density w, then the difference between SRT ($w \sim \gamma^2$) and GRT' ($w \sim \gamma^4$) again has its maximum effect.

6.4 Transformation table

Being transformed are:		SRT	GRT'	GOT
Length measures (length contraction eq. 28.16)	L [m]	$\sim 1/\gamma$	$\sim 1/\gamma$	$\sim 1/\gamma$
Areas (circular motion)	A [m²]	$\sim 1/\gamma$	$\sim 1/\gamma^2$	$\sim 1/\gamma^2$
Volumes (vortical motion)	V [m³]	$\sim 1/\gamma$	$\sim 1/\gamma^3$	$\sim 1/\gamma^3$
Time measures	t [s]	$\sim 1/\gamma$	$\sim 1/\gamma$	= const.
Velocities	v [m/s]	= const.	= const.	$\sim 1/\gamma$
(v = L/t)	c [m/s]	= const.	= const.	$\sim 1/\gamma$
Constants of material	ε [As/Vm]	= const.	= const.	$\sim \gamma$
($\varepsilon\cdot\mu = 1/c^2$)	μ [Vs/Am]	= const.	= const.	$\sim \gamma$
Relativistic mass (increase in mass)	m [kg] [=VAs³/m²]	$\sim \gamma$	$\sim \gamma$	$\sim \gamma^2$
Energy	W [VAs]	$\sim \gamma$	$\sim \gamma$	= const.
Energy density (w = W/V)	w [VAs/m³]	$\sim \gamma^2$	$\sim \gamma^4$	$\sim \gamma^3$
E-, **H**-field strength	**E** [V/m]	$\sim \gamma$	$\sim \gamma^2$	$\sim \gamma$
($w = (\varepsilon\cdot E^2 + \mu\cdot H^2)/2$)	**H** [A/m]	$\sim \gamma$	$\sim \gamma^2$	$\sim \gamma$
Power density (Poynting vector **p** = **E** x **H**)	**p** [VA/m²]	$\sim \gamma^2$	$\sim \gamma^4$	$\sim \gamma^2$
D-field, **B**-field	**D** [As/m²]	$\sim \gamma$	$\sim \gamma^2$	$\sim \gamma^2$
(**D** = $\varepsilon\cdot$**E** ; **B** = $\mu\cdot$**H**)	**B** [Vs/m²]	$\sim \gamma$	$\sim \gamma^2$	$\sim \gamma^2$
Power	P [VA]	$\sim \gamma$	$\sim \gamma^2$	= const.

Table 17: Influence of the Lorentz-transformation in the:
SRT (special theory of relativity): one-dimensional,
GRT' (general theory of relativity): three-dimensional,
to a large extent corresponding to the GRT of Albert Einstein,
GOT (general theory of objectivity)

A relation to the field factors of E- and H-fields are for instance provided by the energy density of a wave field

$$w = (\varepsilon \cdot E^2 + \mu \cdot H^2)/2 \qquad (6.6)$$

According to that the field strengths in the one-dimensional case of the SRT should be converted with the γ-factor, in the case of the GRT' however with γ^2, in accordance with the derivation in chapter 5.

In the domain of the GOT all length measures should be transformed. The respective dimension gives information with which power the γ-factor occurs (table 17). The unit meter is responsible for that.

Let's take a critical look at the root of Lorentz. The velocity v occurring in it, of whatever this may consist, is depending on the field according to equation 5.17. Strictly speaking it would not be constant anymore and would not belong in a general instruction for transformation at all.
Only what is valid for v is valid to the same extent for c. Since only the proportion of v/c occurs in the root of Lorentz every influence depending on field or of other nature will have no effect on v/c and the value of the root of Lorentz. In any case it will retain its value. It fulfills for itself the condition of the ***Lorentz invariance***.

Accordingly, the case of the relative velocity v it does not depend on the absolute value but only on the relation to the speed of light. In addition, the restriction to values of $v < c$ is normal if the speed of light is seen as an upper limit.

6.5 Discussion concerning the root of Lorentz

mathematical consideration:	v = 0	v < c	v = c	v > c
Abbreviations: $\beta = v/c$	$0 <$	$\beta < 1$	$\beta = 1$	$\beta > 1$
and: $\gamma = 1/\sqrt{1-\beta^2}$	$1 <$	$\lvert\gamma\rvert < \infty$	$\gamma = \pm\infty$	imaginary
and: $\gamma^2 = 1/(1-\beta^2)$	1	positive	$\gamma = +\infty$	negative
and: $\gamma^4 = 1/(1-\beta^2)^2$	$1 <$	positive	$\gamma = +\infty$	positive
Examples: Increase in mass, energy $\sim \gamma$ for SRT and GRT	1	positive	$\pm\infty$	complex
Field strength in GRT': $\mathbf{E}, \mathbf{H} \sim \gamma^2$ and mass in GOT: $m \sim \gamma^2$	$1 <$	$\mathbf{E}, \mathbf{H} < \infty$ positive	$+\infty$	$\mathbf{E}, \mathbf{H} < 0$ negative
Energy-, power density $\sim \gamma^4$ (Poynting vector) in GRT:	$1 <$	$\mathbf{P} < \infty$ positive	$\mathbf{P} = +\infty$	$\mathbf{P} < \infty$ positive

Table 18: Discussion concerning the root of Lorentz

$$\sqrt{1-\beta^2} = 1/\gamma = \sqrt{1-(v^2/c^2)} \qquad (6.7)$$

Consequences are i.e.:

- The special theory of relativity SRT only is defined for $v < c$
- For $v > c$ particles with a complex mass, but with a real energy density (according to GRT') would result.
- From the point of view of the theory of objectivity (GOT) the mass should be taken negative-real (e.g. neutrino-properties)!

Let's first purely mathematically draw a case distinction for different velocity domains of v. For $v = 0$ the root of Lorentz becomes "1" and the Lorentz transformation turns into the Galilei transformation.

Connected to this is today's well-known and technically used domain up to the limit of $v = c$. It is virtually impossible to accelerate a mass particle to the speed of light since mass, field, and energy would grow towards infinity, made clear in the table 17. Particles as fast as light, like photons, hence cannot have a mass. At $v = c$ a singularity is present.

In a "*real*" field theory an upper limit must not be present. Hence, the case for $v > c$ should be required theoretically. Only later we will be able to judge if this makes sense physically. At first we only want to examine the case mathematically. Mass, field, and energy now again have a finite value, resulting in a complex, purely imaginary mass, a negative field, and in doing so, as already stated before, a positive energy and power density.

7. Neutrino power and future prospects

At one time there was the textbook opinion that it is physically impossible to fly faster than sound. This erroneous statement even could be proven "*scientifically*". It was believed that a supersonic airplane would fly off the observation space and with that would not be real anymore, thus from a mathematical viewpoint would be complex. Anyone who has flown from Paris to New York getting off a Concorde can confirm that everything at any moment of the flight was real. Only the observer is deceived if the airplane flies somewhere else than he perceives it to be.

7.1 Mathematical derivation of the neutrino

Is the speed of light also such a "*sonic barrier*", by which the majority of the scientists since Einstein until today still hold to be insurmountable?

How should one physically imagine a complex mass?

Let us remember the alternating current teachings, where it is normal to work with complex values, since the mean values of the oscillating alternating currents, tension voltages, and fields are zero.

Calculating with mean values would result in zero energy and power. Hence complex factors are introduced and the root mean square values are calculated and measured instead of the mean values. Could a complex mass analogously not concern an oscillating particle, a particle, which is faster than the speed of light?

In the domain of speeds faster than light, for v > c, the power series (5.16) does not converge anymore and every observer theory and every observation will fail because particles faster than light run away from their own visible appearances. Every measurement and every observation inevitably is behind and hardly can be assigned to the actual cause.

That way for instance measured neutrino events are being connected with celestial observations with which they have nothing to do with.

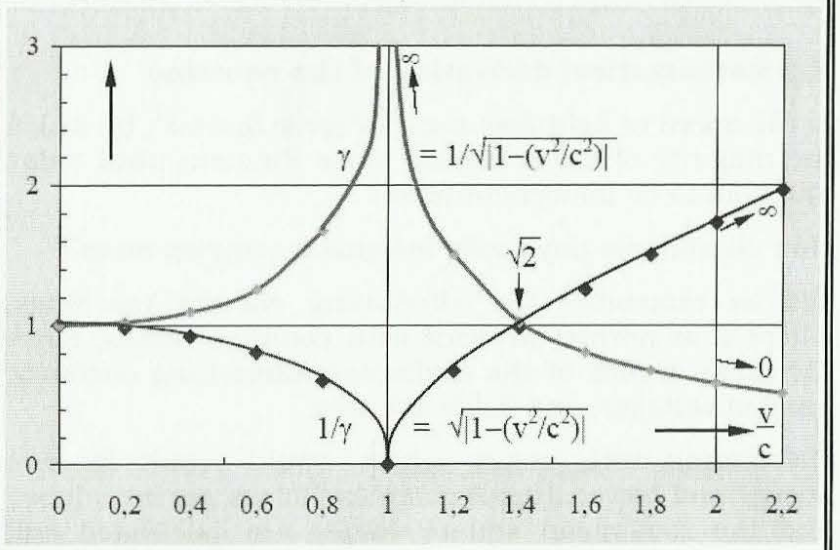


Table 19: Root of Lorentz for speeds faster than light

However, if we describe the domain v > c in the complex plane then astonishing results are found, which can be verified physically: a complex length dilatation with increasing velocity goes along with a loss of complex mass.

The oscillating fields, energy and power density however would be real with negative sign.

Thus, there would result particles carrying energy with an opposite poled field with an oscillating mass and if necessary an oscillating charge.

Without static mass and charge these particles hardly would interact with normal matter which leads to an enormous ability of penetration. The only physical particles which have such a property are the **neutrinos**.

7.2 The technical use of neutrino power?

With that a usable and an extremely efficient model description has been found for these particles. Also the energy of these particles can be calculated with considerable orders of magnitude and is available as an energy source everywhere and any time.

If for instance in a converter for space energy a neutrino should be converted into a resting charge carrier (with v = 0) then two steps are necessary:

1. First the neutrino must be slowed down to 1.414 times the speed of light (fig. 19). Doing so energy is spent and not won! For instance the converter can cool down.
2. Afterwards the characteristic rotation of its own has to be taken away from the neutrino with which the ring-like vortex spins around itself by permanently putting its inside to the outside and vice versa. In that way the vortex center is closed and the particle acquires localization. It becomes a charge carrier.

Even if the representation in the complex plane represents only an auxiliary description, the model nevertheless seems to be efficient because despite its complex mass and charge the neutrino nevertheless carries a real energy. In any case, it is represented in that way to an observer who measures the relation with the speed of light, and who, in the relativistic scheme of things, scans the relation.

Today, as noted previously, even the sonic barrier has become permeable and no scientist dares to physically deny this fact and even prove his mistake mathematically anymore. No, on the contrary he always claims he did know that an expected consequence is that the sonic barrier runs after the supersonic plane. The once physically unthinkable and scientifically fought has become normality.

What should hinder an oscillating particle, like a neutrino, to be faster than the light? Some time one also will accustom to that. ...

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8. Index of abbreviations

	Electric field			Magnetic field	
E	V/m	Electric field strength	**H**	A/m	Magnetic field str.
D	As/m²	Electric displacement	**B**	Vs/m²	flux density
U	V	Tension voltage	I	A	Current
b	V/m²	potential density	**j**	A/m²	Current density
ε	As/Vm	Dielectricity	μ	Vs/Am	Permeability
Q	As	Charge	ϕ	Vs	Magnetic flux
e	As	Elementary charge	m	kg	Mass
τ_2	s	Relaxation time constant of the potential-vortices	τ_1	s	Relaxation time constant of the eddy currents

other symbols and Definitions:

Specific electric conductivity	σ	Vm/A
Electric space charge density	ρ_{el}	As/m³
Dielectricity	$\varepsilon = \varepsilon_r \cdot \varepsilon_o$	As/Vm
Permeability	$\mu = \mu_r \cdot \mu_o$	Vs/Am
Speed of light	$c = 1/\sqrt{\varepsilon \cdot \mu}$	m/s
Speed of light in a vacuum	$c_o = 1/\sqrt{\varepsilon_o \cdot \mu_o}$	m/s
Time constant of eddy currents	$\tau_1 = \varepsilon/\sigma$	s

Concerning vector analysis:

Bold print = field pointer (vector)

9. Bibliography

1-1: Küpfmüller, K.: Einführung in die theoretische Elektrotechnik, Springer Verlag, 12. Auflage 1988

1-2: Jackson, J.D.: Classical Electrodynamics. 2nd.ed. Wiley & Sons N.Y. 1975

1-3: Maxwell, J.C.: A Treatise on Electricity and Magnetism, Dover Publications New York, (orig. 1873)

1-4: Meyl, K.: Scalar wave transponder, INDEL Verlag 2008

1-5: Zinke, Brunswig: Lehrbuch der Hochfrequenztechnik, 1. Band, Springer-Verlag, 3. Aufl. 1986, S. 335

1-6: Lehner, G.: Elektromagnetische Feldtheorie, Springer Verlag, 1.Aufl. 1990

1-7: D.J.P.Morris et al: Magnetische Monopole in magnetischem Festkörper entdeckt, file:///E:/K1/Dateien%200-9/K6%20Forschung/Forschungsdokumente/magnetische%20monopole%20entdeckt.htm, Pressemitteilung v. 3.9.2009 der Hermann von Helmholtz-Gemeinschaft Deutscher Forschungszentren e. V. Berlin

1-8: David Ash, Peter Hewitt: Science of the gods, Gateway Books, Bath, England 1990

1-9: Meyl, K.: Potentialwirbel Band 1 INDEL-Verlag 1990

1-10: Meyl, K.: Dreidimensionale nichtlineare Berechnung von Wirbelstromkupplungen, Dissertation Universität Stuttgart 1984

1-11: Meyl, K.: Wirbel des elektrischen Feldes, EMC Journal 1/1995, 6. J, ISSN 0945-3857, S. 56 - 59.

1-12: A. Yializis, S. W. Cichanowski, D. G. Shaw: Electrode Corrosion in Metallized Polypropylene Capacitors, Proceedings of IEEE, International Symposium on Electrical Insulation, Bosten, Mass., June 1980

1-13: D. F. Taylor, On the Mechanism of Aluminium Corrosion in Metalized Film Capacitors, IEEE Transactions on EI-19, August 1984, No.4, pp.288-293

2-1: Lugt, H.J.: Wirbelströmung in Natur und Technik, G. Braun Verlag Karlsruhe 1979, Bild „Tornado", Seite 356

2-2: Maxwell, J.C.: A treatise on Electricity and Magnetism, Dover Publications New York, (orig. 1873).

2-3: Pohl, R.W.: Einführung in die Physik, Band 2 Elektrizitätslehre, 21.Aufl. Springer-Verlag 1975

2-4: Küpfmüller, K.: Einführung in die theoretische Elektrotechnik, Springer Verlag 12. Aufl. 1988

2-5: Bosse, G.: Grundlagen der Elektrotechnik II, BI-Hochschultaschenbücher Nr.183, 1. Aufl. 1967

2-6: Simonyi, K.: Theoretische Elektrotechnik, Band 20, VEB Verlag Berlin, 7.Aufl. 1979, Seite 924

2-7: Grimsehl: Lehrbuch der Physik, 2. Bd., 17. Aufl. Teubner Verl. 1967, S. 130.

3-1: Bronstein u.a.: Taschenbuch der Mathematik, 4. Neuauflage Thun 1999, S. 652

4-1: D.J.P.Morris, D.A.Tennant, S.A.Grigera, B.Klemke, C.Castelnovo, R.Moessner, C.Czternasty, M.Meissner, K.C.Rule, J.-U. Hoffmann, K.Kiefer, S.Gerischer, D.Slobinsky, R.S.Perry: Dirac Strings and Magnetic Monopoles in the Spin Ice $Dy_2Ti_2O_7$, *Science* 16 October 2009, Vol. 326. no. 5951, pp. 411 - 414

4-2: Blume, S.: Theorie elektromagnetischer Felder, 4.Aufl. Hüthig Verlag Heidelberg 1994

4-3: Flügge, S.: Rechenmethoden der Elektrodynamik, Springer Verlag Berlin 1986

4-4: Küpfmüller, K.: Einführung in die theoretische Elektrotechnik, Springer Verlag, 12. Auflage 1988

4-5: Simonyi, K.: Theoretische Elektrotechnik, Band 20, VEB Verlag Berlin, 7.Aufl. 1979

4-6: Lehner, G.: Elektromagnetische Feldtheorie, Springer Verlag, 1.Aufl. 1990

4-7: Meyl, K.: Scalar wave transponder, INDEL Verlag 2008

5-1: Meyl, K.: Scalar Waves, From an extended vortex and field theory to a technical, biological and historical use of longitudinal waves. INDEL Verlag 2003
Materialsammlung in deutsch: Skalarwellen, 1996-2003

5-2: Grimsehl: Lehrbuch der Physik, 2.Bd., 17.Aufl. Teubner Verl. 1967, S. 130.

5-3: R. W. Pohl: Einführung in die Physik, Bd. 2 Elektrizitätslehre, 21. Aufl. Springer-Verlag 1975, S.72,76,130

5-4: K. Simonyi: Theoretische Elektrotechnik, 7.Aufl. VEB Berlin 1979, Seite 924.

5-5: E. Friebe: Die Vektorprodukte der Maxwell'schen Elektrodynamik, DPG-Didaktik-Tagungsband 1995, S. 396

5-6: O.E.Rössler: Endophysics, the World as an Interface, World Scientific Publishing Co. 1998, Kap. 10, S. 87-112, mit Übersetzungen aus R.J.Boscovic: De spatio et tempore, ut a nobis cognoscuntur, 1755.

Lit. 1-7 and 4-1: **Dirac Strings and Magnetic Monopoles in the Spin Ice $Dy_2Ti_2O_7$**

Originally published in *Science* Express on 3rd of September 2009, *Science* 16 October 2009: Vol. 326. no. 5951, pp. 411 - 414, DOI: 10.1126/science.1178868

Reports (summary)

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Sources of magnetic fields—magnetic monopoles—have so far proven elusive as elementary particles. Condensed-matter physicists have recently proposed several scenarios of emergent quasiparticles resembling monopoles. A particularly simple proposition pertains to spin ice on the highly frustrated pyrochlore lattice. The spin-ice state is argued to be well described by networks of aligned dipoles resembling solenoidal tubes—classical, and observable, versions of a Dirac string. Where these tubes end, the resulting defects look like magnetic monopoles. We demonstrated, by diffuse neutron scattering, the presence of such strings in the spin ice dysprosium titanate ($Dy_2Ti_2O_7$). This is achieved by applying a symmetry-breaking magnetic field with which we can manipulate the density and orientation of the strings. In turn, heat capacity is described by a gas of magnetic monopoles interacting via a magnetic Coulomb interaction.

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Lit.:1-11: **Vortex of the electric field**
A new EMC Interference source?
EMC Journal 1/1995, Page 56 – 58

English Abstract:
Hypothesis: Supposing the electric field were - just as the magnetic field - a vortex field, the developing potential vortices in the dielectric medium would consequently occur in the air as well. It has to be reckoned with this field phenomena could have an effect on technical and biological systems in our dielectric environment.

As a possible interference factor, the potential vortex would play a key role in the field of electromagnetic compatibility. Nyquist-noise, dielectric loss as well as vortex structures, visible especially in high-tension condensers, suggest the existence of the vortex. Special characteristics of the vortex and possible consequences for EMC practice are indicative.

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* *Author:* Prof.-Dr.-Ing. Konstantin Meyl, Transfer Center

* Editorial remark*:* The two books of Professor Dr. Meyl with the title: "Potential vortex" Vol.1 and Vol.2 have been awarded in November, 1994 by the German Society for EMC Technology. The present text is based on the speech of the author held at the award ceremony in Munich.

Original German text (paper published January 1995):
Wirbel des elektrischen Feldes,
Eine neue Störquelle? Fachbericht
EMC **JOURNAL** 1/1995, ISSN 0945-3857
6. Jg., KENNZIFFER 397, Page 56 - 59