Ashdin Publishing
Journal of Vortex Science and Technology
Vol. 1 (2012), Article ID 235563, 10 pages
doi:10.4303/jvst/235563

*Research Article*

# About Vortex Physics and Vortex Losses

**Konstantin Meyl**

*1st TZS, Erikaweg 32, D-78048 Villingen-Schwenningen, Germany*
*Address correspondence to Konstantin Meyl, prof@meyl.eu*

Received 16 March 2012; Accepted 15 June 2012

**Abstract** As quantum physics nowadays tries to reframe and explain electric and magnetic field phenomena, we must not be mislead over the fact that quantum physics remains a "stepdaughter" of field physics based solely on postulates until eventually it will have found a way to calculate its quanta. Furthermore, field physics is at least 25 times older and can be traced back all the way to the early Greek natural philosophers. Vortex physics is another offspring of field physics, however, it has been systematically rejected by quantum physics. Which in turn often times has a lot to do with politics and not always with science. It could in fact be the case that vortex physics has been suppressed by its own "sister," ever since it also has produced distinguished representatives. A mathematical derivation shows that the currently known formulas and laws of electrodynamics are incomplete and insufficient in describing all its associated phenomena. Via a new formulation and extension of Maxwell's equation it becomes possible to calculate a potential vortex, its effect on the dielectric medium can be measured and its existence made evident through observable natural phenomena.

**Keywords** vortex physics; potential vortex; duality; vortex losses; capacitor losses

## 1 Introduction

In order for these preliminary statements not to contradict known general conclusions, they have to include the following, vortices occurring in nature or technology as a matter of principal cannot be calculated or measured and in general are not visible. They are there for out of reach of our precise scientific methods, which seems to make it practically impossible to prove their existence.

Looking at this in depth we can thus conclude the following.

Calculating a vortex strictly speaking already stalls with the attempt of forming a field equation that is able to determine its dimensions in space and time. Even by taking into consideration all mathematical methods at hand, this four dimensional field equation (a type of thermal conduction equation) is set to be unsolvable. Such an equation can there for only be resolved by applying simplified assumptions on the vortex's dimensions in space and time [11].

On trying to measure it we are faced with the same dilemma. Any kind of measuring probe we use would disrupt the vortex and cause it to swerve aside. We could at best detect anomalies, which would in varying measuring attempts lose their repeatability.

We are ultimately having to measure and calculate the vortex effects, e.g., its losses and compare those results [11].

Negligence and measurement errors pose an additional difficulty on our way to finding proof of existence for vortices.

We are there for relying less on measurements, in relation to eddy currents, but much more on the existence of the established equations of Ampère's law (1826) and the law of induction (Faraday 1831), which J. C. Maxwell in 1873 compiled and complemented.

It would be hard to imagine the losses of eddy currents not to be identifiable and interpretable as such, without a set of equations. Rather a lack of uniformity, linearity and specific material properties would in this case be accepted as an explanation from a scientific point of view, then the actual causal, but not measurable eddy currents.

This analogy ought to make us reconsider. It implies that neither the measuring of effects, nor the observation of phenomena of a vortex would suffice as a scientific proof of its existence. Only a mathematical description of the vortex through an appropriate field equation can be deemed satisfactory, from a precise scientific view point.

## 2 Dual vortex phenomena in fluid mechanics

In fluid engineering convincing and strong indications for the correctness of the chosen approach can be found [8]. It benefits us that hydrodynamic vortices are visible, e.g., the injection of smoke into a wind tunnel.

Already *Leonardo da Vinci* had observed in liquids the existence of *two basic types of vortices in duality:* "one of these vortices moves slower at the center than it does at its perimeter and the other moves faster at its center than it does along the perimeter."

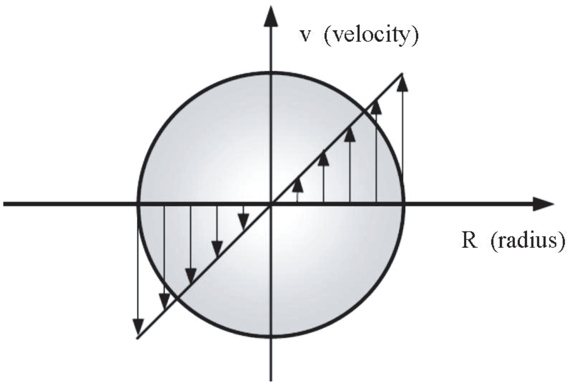



**Figure 1:** Velocity distribution $v(R)$ for a vortex with rigid body rotation.

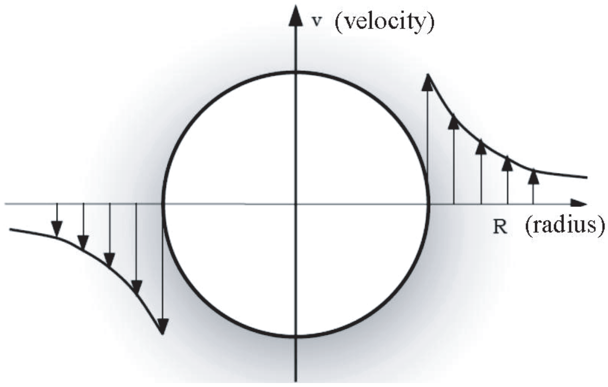



**Figure 2:** Velocity distribution $v(R)$ in a potential vortex [8].

A vortex of the first type, also called "*vortex with rigid-body rotation*," is formed, for instance, by a liquid in a centrifuge, that due to its inertia of mass is pressed against the outer wall because there the largest velocity exists. In an analogous way the electromagnetic vortex in electrically conductive material shows the well-known "skin effect" (Figure 1).

To explain the other vortex, *Newton* describes an experiment in which a rod is dipped into a liquid as viscous as possible and then turned. In this potential vortex the velocity of the particle increases the closer to the rod it is (Figure 2).

The duality of both vortex phenomena becomes obvious by bringing to mind that in the experiment with the centrifuge the more liquid presses towards the outside the less viscous the medium is. And that on the other hand the potential vortex forms the stronger the more viscous the medium is.

As conclusion we read in text books that *the viscosity of the liquid decides whether a vortex with rigid-body rotation or a potential vortex is formed*.

When we, in a third experiment, immerse the centrifuge filled with water into a dense medium and rotate the centrifuge, then inside the centrifuge a vortex with rigid-body rotation forms and outside the centrifuge a potential vortex (Figure 3).

It is obvious that either vortex always causes the other vortex with opposite properties and so *the existence of one causes that of the other*. So in the first case, that of the vortex with rigid-body rotation, outside the centrifuge potential vortices will form in the surrounding air, whereas in the second case, that of the potential vortex, the turning rod itself can be interpreted as a special case of a vortex with rigid-body rotation.

Hence in all conceivable experiments the condition always is fulfilled that in the center of the vortex the same state of "peace," which we can term "zero," prevails as an infinity.

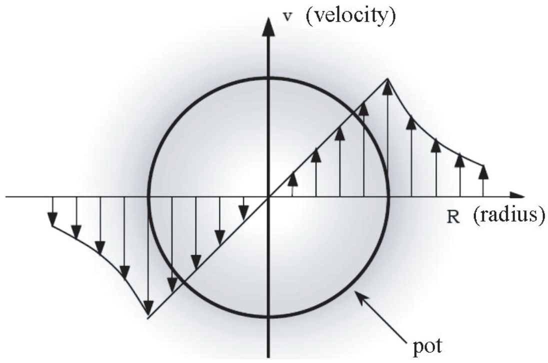



**Figure 3:** Combination of a vortex with rigid-body rotation and a potential vortex [8].

When we take a tornado as an example, thus a whirlwind. In the "eye of the cyclone" there's no wind at all. But if I was to leave the center, I would be blown to the outside. One could really feel this vortex with rigid-body rotation on the inside. If, however, one was to stand on the outside, the potential vortex would try to pull you towards its center. This potential vortex is responsible for the structure and in the end also for the size of the tornado (Figure 4).

At the *radius of the vortex*, the place with the highest wind speeds, an *equilibrium* prevails. The vortex with rigid-body rotation and the potential vortex at this point are equally powerful. Their power again is determined by their viscosity, which in turn sets the radius of the vortex.

Therefore meteorologists pursue with interest whether a tornado forms over land or over water. Over the ocean for instance it sucks itself full with water. In that way, the potential vortex increases in power, the radius of the vortex gets smaller and the energy density increases dangerously.

## 3 Dual vortex phenomena in electrical engineering

If the knowledge from hydrodynamics is transferred over to the area of electromagnetics, then the role of viscosity is

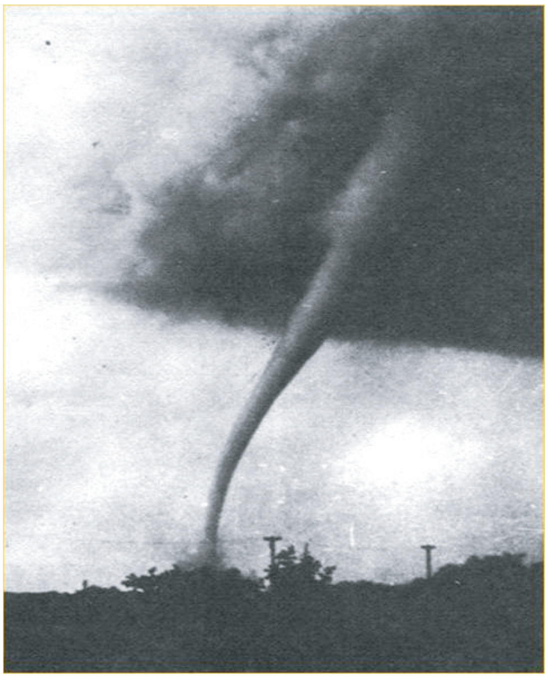


**Figure 4:** Tornado, composed of expanding vortex from inside and counter vortex contracting from outside.

taken on by the electric conductivity. The well-known current vortex occurs in the conductor, whereas its counterpart, the potential vortex, forms in the poor-conducting medium, with preference in the dielectric.

*The duality of both vortices is expressed by the fact that the electric conductivity of the medium decides whether eddy currents or potential vortices can form and how fast they decay, i.e., convert their energy into heat*. Figure 3 shows that vortex and anti-vortex mutually cause each other.

In *high tension transmission lines* we find a striking example for the combination of current vortex and potential vortex.

Within the conductor eddy currents are formed. Thus the current density increases towards the surface of the conductor (skin effect).

Outside the conductor, in the air, the alternating fields find a very poorly conducting medium. If one follows the text book opinion, then the field outside the conductor should be a *non-rotational gradient field*. But this statement causes unsolvable problems.

When *vortices* occur *inside the conductor*, because of a detachment of the vortices without jumps at the interface to the dielectric, the fields in the air surrounding the conductor must also have the form and the properties of vortices. Nothing would be more obvious as to mathematically describe and interpret these so-called gradient fields as *vortex fields as well*. On closer inspection this argument is even mandatory.

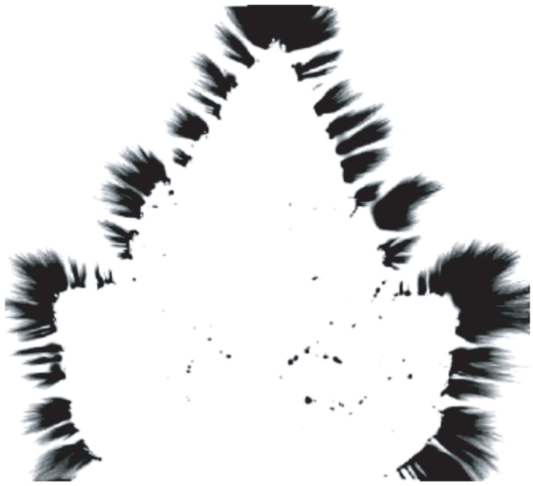


**Figure 5:** Kirlian photograph of a leave.

The laws of field refraction known as *boundary conditions* [6] in addition demand *steadiness* at the interface of the conductor to the dielectric and do not leave us any other choice. If there is a vortex field on one side, the field on the other side is also a vortex field, otherwise we would be breaking the law. Here an obvious *failure of the Maxwell theory* is evident.

Outside the conductor, in the air, where the alternating fields find a very little conducting medium the potential vortex not only exists theoretically; it even shows itself. Dependent, among other things, on the frequency and the composition of the surface of the conductor, the potential vortices form around the conductor. If the thereby induced potentials exceed the initial voltage, then impact ionization takes place and the well-known *corona discharge* is produced [4]. Everyone of us can hear this as crackling and see the sparkling skin with which high tension transmission lines cover themselves.

In accordance with the text books, the gradient field increases towards the surface of the conductor too, but an even shining would be expected and not a crackling. Without potential vortices the observable structure of the corona would remain an unsolved phenomenon of physics.

But even without knowing the structure-shaping property of the potential vortices, which we have to conclude acts as an additional support, it can be well observed that especially roughness on the surface of the conductor stimulates the formation of vortices and actually produce vortices. If one is looking for a reason why, with high frequency, the very short impulses of discharge always emerge from surface roughness [6], one will probably find that potential vortices responsible for it.

By means of a *Kirlian photograph* it can be shown that the corona consists of structured separate discharges (Figure 5).

Students of electronic engineering (1991) were able to produce photos of the leaf, using their self built high voltage device in the darkroom, even after the original had been removed. The potential vortices still present under the plexiglas remained detectable by their storage effect.

Several authors have called this a "phantom leaf effect" and it has often been misinterpreted as a paranormal phenomenon [5].

In reality this is due to the potential-vortex storing capacity having been made visible, which has only ended up in the field of parascience, because Maxwell's field theory did not stipulate a potential vortex.

With this the approach is motivated, formulated, and given reasons for. The expositions cannot replace a proof, but they should stand a critical examination. Let us proceed on our quest for more examples.

## 4 Extended field theory according to the rules of duality

The commonly used explanation for the *after-effect in the dielectric* is hardly convincing [6].

By magnetizing a magnetic ring made from solid iron, the currant builds up in the direction counter to the inducting electric power at a time delay. We know what the rational for that is [11]: we are dealing with eddy currents opposing the cause and there for working against any sudden leap in excitation, only to taper off and eventually to decay.

With the help of this vortex-theory on hand, the after-effect in the dielectric, hence the characteristic discrepancy between the measurement and the calculation of the progression of the charging process of insulation materials, can now be explained conclusively: the time delay we can observe during the charging process of a dielectric, has its origin in the occurrence of potential vortices counteracting the sudden changes and which only collapse with a time lag.

The well-known rules of duality lend themselves naturally to the computation of the potential vortices, which are supposed to be dual to eddy currents. In any case, this is a quick and straight forward way to archiving the required extension of Maxwells field equation. One disadvantage to be considered, is the fact that the potential vortex has only been postulated and not mathematically derived, although a traditional method, this still regularly invokes criticism.

Also Maxwell was being criticized for that for over 25 years until Heinrich Hertz found the experimental verification. Maxwell had managed to do so without cogency of proof. According to theoretical considerations he did lei the mathematical foundations for wave propagation and thereby et al. a physical explanation of light. The success was possible when he extended the law of Ampère by the dielectric displacement. But at his time, this only had been a postulation.

In accordance with the derived structured arrangement and the need for a tantamount (dual) description of the magnetic and electric field, the theory on the law of induction would now require to look like the extended Ampère law. This however has not been implemented, which is why the law of induction in its new configuration needs to be extended by a vector of the potential density.

The equation demonstrates that the discovery of the potential vortex in electrodynamics is only the logical consequence of calculating consistently. Because the new vector of the potential-density $\mathbf{b}$ [V/m] has the same dimension as the change in flux density ($\delta\mathbf{B}/\delta t$), its implementation should turn out to be relatively unproblematic.

The consequences connected to this extension of the field theory will therefore appear to be all the more overwhelming. We will conclude the following.

As a point of discussion we put forward, that in the field of electro-magnetism two dual vortex phenomena with opposing properties crop up. In materials of good conduction current vortices can build up, which are equivalent to the fixed vortex and expand in the same way, also known as skin effect.

Ampère's law and the law of induction in their original formulation will suffice as a mathematical description.

The vortex counter to that forms in media of weak conductivity, in the so-called dielectric. We will focus entirely on the newly introduced potential vortex.

It is part of the task and area of responsibility of scientists, particularly in this day and age, not to be satisfied merely with the mathematical explanation of a newly discovered phenomena, but to also concern themselves with the consequences and effects it could be having on all of us and to set the discussion on that in motion.

For this purpose, we will, first of all, consider some of the properties of the potential vortex.

## 5 Concentration effect

It can be assumed that until now there does not yet exist a technical application for the potential vortex theory presented here, unless the phenomenon was used by chance and unknowingly. The transmission of optical light signals via a fibre optic cable can be given as a typical example.

Compared to the transmission of energy impulses using a copper cable, fibre optic cables show a considerably *better degree of efficiency*. The derived potential vortex theory provides a conclusive explanation for this phenomenon and therefore is put here for discussion.

If we cut through a fibre optic cable and look at the distribution of the light impulse over the cross section, we observe a concentration in the center of the conductor (Figure 6).

Here the duality between the vortices of the magnetic and the electric field comes to light. Whereas the eddy currents in a copper conductor cause the well-known "*skin effect*," potential vortices show a "*concentration effect*" and align themselves along the vortex center. The measurable

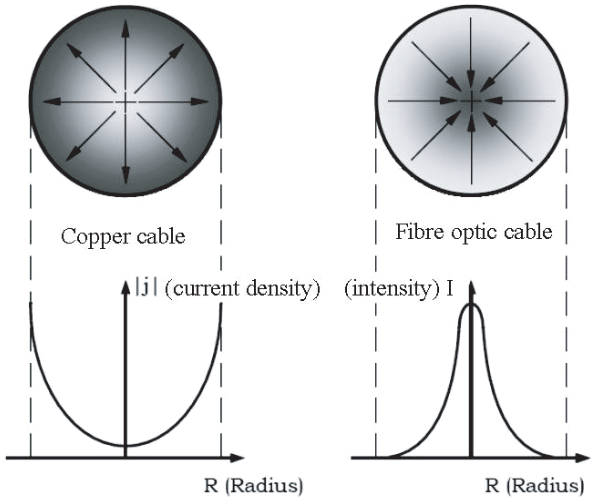



**Figure 6:** Distribution of the current density (eddy currents) in a copper cable (left side) compared to the distribution of light (potential vortex) within a fibre optic cable (right side).

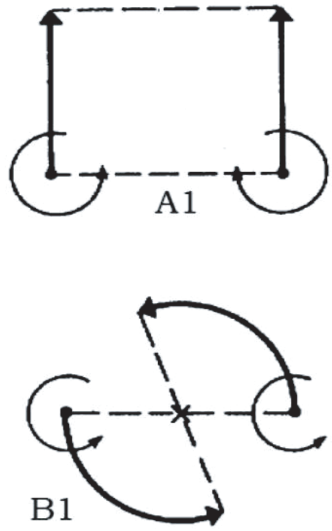



**Figure 7:** Motion of two point vortices: (A1) with opposite direction, (B1) with the same direction of rotation [8].

distribution of the light intensity in a fibre optic cable, as shown in Figure 6, may confirm this phenomenon of the orientation of the potential vortex on the vortex center.

For instance the calculation of the resistance of a copper cable provides, as an important result, an apparent decrease of the resistance towards the surface of the conductor. In this case, because of the higher conductivity, as a consequence, the current density increases as well. In the opposite direction, towards the center of the conductor, consequently, a decrease of the effective conductivity must be present regardless of what type of materials are being used. According to the rules of duality, we have found a condition for the formation of potential vortices. As mentioned earlier, the conductivity is responsible for generating vortices if the expanding eddy current with its skin effect or the contracting potential vortex with its concentration effect are predominant.

Usual fibre optic materials possess not only a small conductivity, but in addition are highly dialectic. This additionally favors the formation of vortices of the electric field. If one consciously or unconsciously supports the potential vortices, then there is a possibility that the life of the fibre optic cable is negatively influenced because of the concentration effect.

Of course it cannot be excluded that other effects, e.g., reflections or the modes of the light are involved in the concentration effect. But it should be guaranteed that this actually concerns causal phenomena and does not concern only alternative explanations out of ignorance of the active vortex phenomenon.

As a consequence, the formal mathematical reason for the concentration effect provides the reverse conclusion in Faraday's law of induction compared to Ampère's law according to the rule of Lenz.

## 6 Vortex balls and vortex lines

It can be assumed that the vortex of the electric field is relevant with regards to the electromagnetic environmental compatibility. This then holds not only for microcosmic and microscopic vortices, but also for macroscopic and larger dimensions. The individual vortices can join together as balls and lines. For the study of this process, it is useful to again fall back on experiments in flow dynamics [8].

The cooperation of individual point vortices has been investigated thoroughly in flow dynamics. Without any outside manipulation an individual vortex rotates on the spot.

That changes in the case of two neighboring vortices. Now it depends on their mutual strength and sense of rotation. If they have the opposite sense of rotation and equal strength then their centers of rotation move straight forward in the same direction.

If, however the direction of rotation is the same, then both vortices rotate around each other (Figure 7).

In this way, a multitude of point vortices is possible to form, in the first case whole *vortex streets* and in the second case *spherical vortex balls*. In principle, a vortex string can also consist of a multitude of potential vortices pointing in the same direction; but it has the tendency to roll up to a vortex ball in case it is disturbed from the outside, as can be shown very clear by means of computer simulations [15] (Figure 8).

As a starting point for a discussion, the thesis can be put forward that also electric field vortices, in nature usually consisting of a multitude of individual point vortices, appear as vortex strings and vortex balls.

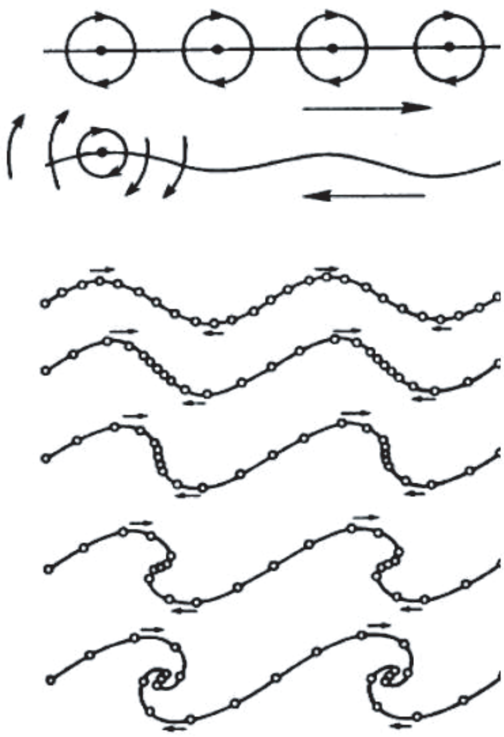


**Figure 8:** The rolling up of a vortex chain to a ball for the smallest disturbance (according to [15]).

Scheller's test procedure has also yielded interesting results (5): in the presents of strong vortex fields, so-called pathogenic areas, normal blood gradually forms little granules, spheres, bubbles and strings. It seems transform and curl up. In connection with mobile telephone systems one nowadays calls it "blood roll phenomenon."

## 7 Transport phenomenon

The vortex principle is self-similar. This means that the properties of an individual vortex also apply to a group of vertices together and can be observed in a similar manner. That is why a vortex ball behaves very similar to an individual isolated vortex. The same concentration effect, that keeps the vortex together, shows its effect on the vortex ball and also keeps it together.

Something corresponding holds for a basic property of potential vortices, being of a completely different nature. It is the property *to bind matter in the vortex and carry it away with the vortex*.

The vortex rings that skilful cigarette smokers can blow in the air are Well known. Of course also non-smokers can produce these eddy currents like rings of air with their mouth but these remain invisible. Solely by the property of the vortex ring to bind the smoke, does this become visible to the human eye?

If our potential vortex is to transport something, then it should rather be a dielectric material, so preferably water. Therefore, in the ambient air we are surrounded by potential vortices, which we can detect for instance as noise, are capable with their "*phenomenon of transport*" to pick up water and to keep it in the vortex.

In this way, the *atmospheric humidity* is explicable as the ability of the air particles to bind comparatively heavy water molecules. If the vortex falls apart then it inevitably releases the water particles and it *rains*. This is merely a charming alternative for the classical representation without claim to completeness.

This phenomenon of transport again appears with *water colloids*. The involved water molecules form a spherical object with a negative charge. They turn their negatively charged side to the outside and point with the positively charged end in the direction of the middle of the sphere. There, in the center of the vortex ball, no longer discernible from the outside, a negatively charged ion can be stuck, no longer able to escape and it gives the whole colloid its characteristic property.

In this way, nature knows various water colloids that constitute plants and animals. But starting at a temperature of 41 °C these *liquid crystals* fall apart. Not just by chance is this the temperature at which a person dies.

Already 10 millivolts per liquid crystal suffice to cause an electrically induced death.

In the atoms we can find an identical colloid structure. Here the atomic nucleus is held in the inside of a vortex-like cloud of electrons, the atomic hull.

We will come back to the phenomenon of transport one more time when we derive the Schrödinger equation and the quantum properties of *elementary particles* [14].

## 8 Vortex losses

Conductive materials like silver, copper or aluminium heat up by electrical currents and eddy currents.

Dielectrics, as they are used in capacitors and insulating 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 nonconductor gets hot.

Electrets and other ferroelectric materials with 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 $\delta$ represents the dielectric losses. This is what we learn from our textbooks [6].

However, this entails a complex dielectric coefficient:

$$\varepsilon = \mathrm{Re}\{\varepsilon\} + j\,\mathrm{Im}\{\varepsilon\} \tag{1}$$

with the loss factor

$$\tan\delta = \mathrm{Im}\{\varepsilon\}/\mathrm{Re}\{\varepsilon\}, \tag{2}$$

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

$$\varepsilon \cdot \mu = 1/c^2, \tag{3}$$

which is an offence against the basic principles of physics.

A transient hysteresis $D(E)$-characteristic would also have to appear in dielectric, 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?

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 dielectric losses that have not yet been investigated are considered and summed up under the loss factor (2).

## 9 The field theory from Maxwell's desk

At least, this physically wrong model is in many cases able to deliver useful arithmetic values [6]. 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 $\varepsilon$ 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 [3].

Here the vector potential **A** is introduced mathematically correct. Physically speaking, 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 the vortex decay, because doing so both ways at the same time is mathematically impossible.

In his book "*A Treatise on Electricity and Magnetism*" [9], J. C. 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 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. Professor Hertz agreed and professor Gibbs wrote down the truncated field equation in its currently still commonly used notation of vector analysis.

Since then the field theory has not been able to describe longitudinal waves even though they had been proven by *Tesla* in 1894 [13]; and they had to be postulated over and over again, for example, for the near field of an antenna [21].

## 10 The vector potential

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

$$\mathbf{B} = \mathrm{curl}\,\mathbf{A}. \tag{4}$$

As a consequence of this mathematical statement the divergence of the magnetic flux density **B** is zero.

$$\mathrm{div}\,\mathbf{B} = \mathrm{div}\,\mathrm{curl}\,\mathbf{A} = 0. \tag{5}$$

Jackson [3] and his followers [7] viewed magnetic monopoles in $\mathrm{div}\,\mathbf{B}$. As long as they do not exist, the field physicists want to see a confirmation for the correctness of (5) (3rd Maxwell equation). This has been the presumption until now.

On September 3rd, 2009, the *Helmholtz center* in Berlin, Germany, announced [2]: "*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

$$\mathrm{div}\,\mathbf{B} \neq 0. \tag{6}$$

With my approach even the *Aharonov Bohm* effect is explainable, generating scalar waves, that are verified after they have tunneled through a screening. According

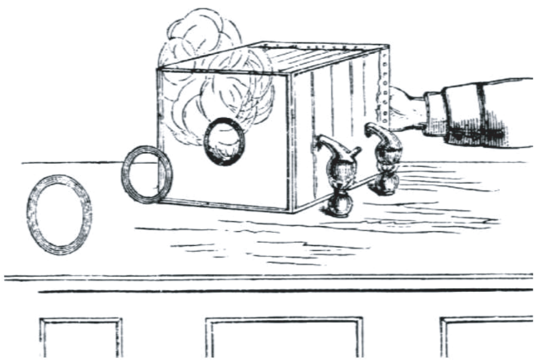


**Figure 9:** Vortex rings from a smoke vortex gun.

to today's interpretation [7] this effect with no measurable field is assigned to the vector potential and even spoken of as evidential value.

## 11 Helmholtzian ring-like vortices in the aether

The doubts about 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 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*."

Through 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 to his contemplations.

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 as a fluid dynamics analogy (Figure 9, [1]).

But he did not have a suitable field theory.

For a short time Germany exported vortex physics to England, before it was buried by the German quantum physicists. A primary advocate was J. C. Maxwell, who held the vortex theory for the best and most convincing description of matter [18, Maxwell: "*. . . the vortex rings of Helmholtz, which Thomson imagines as the true form of the atom, fulfil 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 [17, 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.

In addition, the experimental proof of a vortex transmission as a longitudinal wave through air or a vacuum, as accomplished by Tesla already 100 years ago, is neither with Maxwell's field theory nor with the currently used quantum theory explicable or compatible. We are faced with an urgent need for a new field theory.

## 12 Noise intensity of the capacitor

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

The wave will now rotate around a stationary point, the vortex center. The propagation with the speed of light $c$ is maintained as the rotary velocity. For a plane circular vortex, where the path for one revolution on the outside is a lot longer than near the vortex center, arises a longer wave length and as a consequence a lower frequency on the outside, then on the inside.

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

This property we observe as "white noise." The consistent conclusion would be that this concerns the vortex of the electric field. Anyone can, without big expenses, convince him- or herself that the property to change frequency is dependent on position and of the circumstance that vortices can be very easily influenced and that they avoid or whirl around 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 effect of the manipulation of the receiving signal.

But already the fact that the use and measuring of signals is limited by noise, highlights the need to pay attention to the potential vortex.

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.

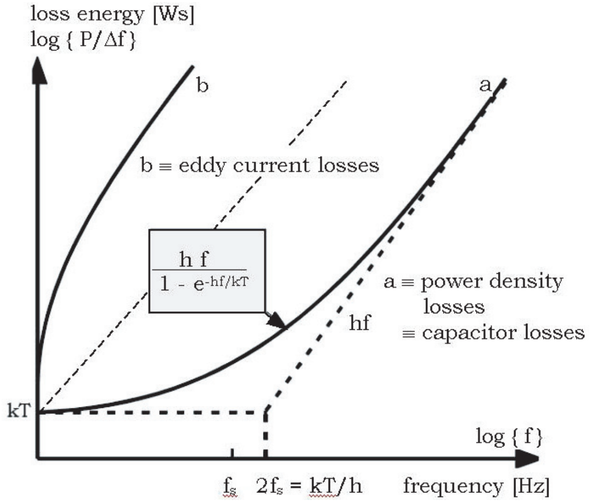



**Figure 10:** The power density shown against frequency for noise (a) according to Küpfmüller [6], as well as for dielectric losses of a capacitor (also (a), [12]) and for eddy current losses (b) according to Meyl [11], (b) in visible duality to (a).

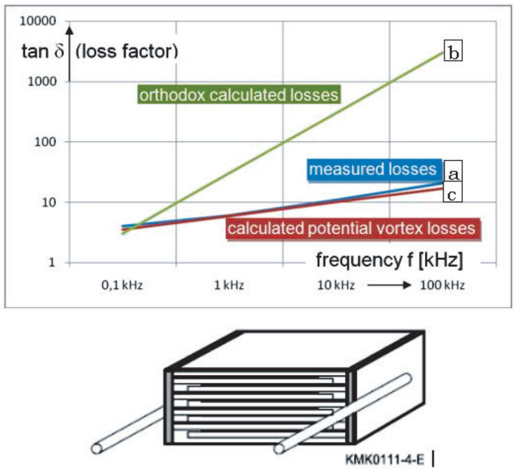



**Figure 11:** Experimental proof of calculated losses (qualitative comparison) with a MKT capacitor [19] (Siemens-Matsushita). (a) Measured dielectric losses of the MKT-capacitor. (b) Standard calculation according to Lorentz-model. (c) Calculation as potential-vortex losses according to Meyl-model.

But this relation does not 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 [6]. Untouched by possible interpretations, an increasing power of the noise is measured, that is, more and more proportional to its frequency [12] (Figure 10, curve a).

Interestingly, this curve shows a remarkable duality to the power output curve of eddy currents, likewise plotted alongside the frequency, which can for instance be measured on eddy current couplings [11] (Figure 10, curve b).

This circumstance suggests a dual relationship of the potential vortex of the electric field in weakly conducting media on the one hand and the eddy current in conductive materials on the other hand [10].

## 13 Capacitor losses

Next, the dielectric losses in a capacitor supplied with an alternating current are measured and also plotted alongside the frequency. At first their progressions are independent of the frequency, but towards the higher frequencies they increase and show the same characteristic course of the curve referring to the power of the noise (Figure 10, curve a).

This excellent correlation leads to the assumption that the dielectric losses are nothing but *vortex losses*.

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

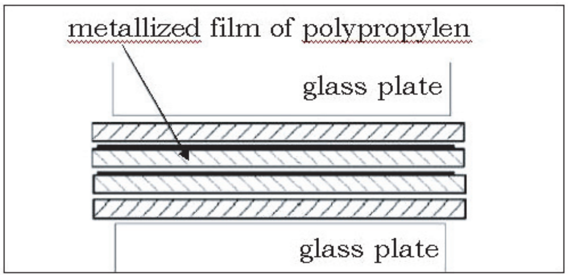
Examples of practical applications are induction welding and the microwave oven. The process can be described in other words as follows: in both examples the cause is posed by high-frequency alternating fields that are irradiated into a dielectric as an electromagnetic wave, there roll up to potential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

The author, in collaboration with a college at the university for theoretical physics in Konstanz as part of a bachelor thesis, recently succeeded in finding a conclusive proof. For this purpose the measured dielectric losses of a standard MKT capacitor were calculated from their frequency dependence and compared. This systematically designed case deviates starkly from the conventionally derived characteristics in accordance with the Lorenz model, the latter of which is at odds with reality and has long been known to be so and criticized by experts. In contrast to that, the characteristic of the potential-vortex losses come much closer to the truth (Figure 11).

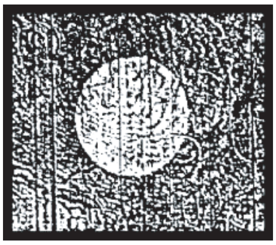
## 14 The visible proof

The striving in the direction of the vortex center 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., tornadoes and whirlwinds).

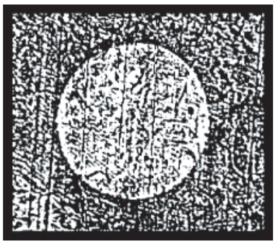
At the same time as the dual anti-vortex arises, so does the diverging eddy current. It takes on, as is well known, the given structure of the conductor, which in the technical literature is referred to as "*skin effect*."




(a) Measurement set up according to Yializis et al. [20].



(b) After 40 hours.



(c) After 52 hours.

**Figure 12:** 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. [20].

Now if conductor and nonconductor meet, as they do in a capacitor, then at the boundary area visible structures will form. Circles would be expected, if the eddy current on the inside striving towards the outside is as powerful as the compressing *potential vortex* drawing in from the outside.

Actually such circular structures are observed on the aluminium 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 (Figure 12) [16,20].

These circular vortex structures can be seen as a visible proof for the existence of potential vortices of the electric field [10].

## References

[1] D. Ash and P. Hewitt, *Science of the Gods*, Gateway Books, Bath, UK, 1990.

[2] Helmholtz-Zentrum Berlin fr Materialien und Energie (HZB), *Magnetic monopoles detected in a real magnet*. http://www.helmholtz-berlin.de/aktuell/pr/pm/pm-archiv/2009/pm-tennant-morris-monopole_en.html, 2009.

[3] J. D. Jackson, *Classical Electrodynamics*, John Wiley & Sons, New York, 2nd ed., 1975.

[4] H. L. König, *Unsichtbare Umwelt*, Moos & Partner, München, 1987.

[5] S. Krippner and D. Rubin, *Der phantom-effekt: Psi sichtbar germacht*, in Lichtbilder der seele, S. Krippner and D. Rubin, eds., Scherz Verlag, Bern, Switzerland, 1975, 206–211.

[6] K. Küpfmüller, *Einführung in die theoretische Elektrotechnik. 12*, Springer-Verlag, Berlin, 1988.

[7] G. Lehner, *Elektromagnetische Feldtheorie*, Springer-Verlag, Berlin, 1990.

[8] H. J. Lugt, *Wirbelströmung in Natur und Technik*, Verlag G. Braun, Karlsruhe, 1979.

[9] J. C. Maxwell, *A Treatise on Electricity and Magnetism*, Dover Publications, New York, 3rd ed., 1954.

[10] K. Meyl, *Wirbel des elektrischen feldes*, EMC Journal, 1 (1995), 56–59.

[11] K. Meyl, *Wirbelströme: Dreidimensionale nichtlineare Berechnung von Wirbelströmen unter Berücksichtigung der entstehenden Oberwellen am Beispiel einer Wirbelstromkupplung*, INDEL GmbH, Villingen-Schwenningen, 2001.

[12] K. Meyl, *From an Extended Vortex and Field Theory to a Technical, Biological and Historical Use of Longitudinal Waves; Belonging to the Lecture and Seminar "Electromagnetic Environmental Compatibility"*, INDEL GmbH, Villingen-Schwenningen, 2003.

[13] K. Meyl, *Scalar Wave Transponder*, INDEL GmbH, Villingen-Schwenningen, 2nd ed., 2008.

[14] K. Meyl, *Potential Vortex.1: From Vortex Physics to the World Equation*, INDEL GmbH, Villingen-Schwenningen, 2nd ed., 2012.

[15] L. Rosenhead, *The formation of vortices from a surface of discontinuity*, Proc. R. Soc. Lond. Ser. A, 134 (1931), 170–192.

[16] D. F. Taylor, *On the mechanism of aluminum corrosion in metallized film AC capacitors*, IEEE Transactions on Electrical Insulation, EI-19 (1984), 288–293.

[17] J. J. Thomson, *A Treatise on the Motion of Vortex Rings*, Macmillan, London, 1883.

[18] W. Thomson, *On the stability of steady and of periodic fluid motion*, Philosophical Magazine, 23 (1887), 459–464.

[19] T. Treskatis, *Frequenzabhängigkeit der dielektrischen Verluste eines metallisierten Kunststoff-Folienkondensators*, 2010.

[20] A. Yializis, S. W. Cichanowski, and D. G. Shaw, *Electrode corrosion in metallized polypropylene capacitors*, in Proc. of the IEEE International Symposium on Electrical Insulation, Bosten, MA, 1980.

[21] O. Zinke and H. Brunswig, *Lehrbuch der Hochfrequenztechnik*, vol. 1, Springer-Verlag, Berlin, 1986.