Electric Scalar Waves - Review to MEYL's Experiment

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On a congress about space energy technology in Bregenz (Austria) Konstantin MEYL[8] has explained his theory of scalar waves in analogy to TESLA's experiments[14]. Then he has demonstrated an experiment which should demonstrate the existence of such (neutrino) waves. This experiment also was presented on other occasions in Germany[10]. The discovery and the evidence of electric scalar waves would be a very important step in electrodynamics and would found a high attention by scientists. Therefore it is necessary that such a breakthrough experiment is checked intensively. With this constructive thoughts this review has been written. It should be used to find more transparency on this subject with an open discussion. For the interest of the space energy research it is essential that new effects (and especially over-unity effects) are proved unambiguous and can withstand every objective criticism.

Theoretical Part

For the theoretical foundation of the scalar waves Konstantin MEYL[8] relates to the undamped wave equation

$$\frac{\partial^2 \mathbf{E}}{\partial x^2} + \frac{\partial^2 \mathbf{E}}{\partial y^2} + \frac{\partial^2 \mathbf{E}}{\partial z^2} = \frac{1}{c^2}\frac{\partial^2 \mathbf{E}}{\partial t^2}$$

$$\Delta \mathbf{E} = \frac{1}{c^2}\frac{\partial^2 \mathbf{E}}{\partial t^2}$$

and shows, that the LAPLACE-Operator Δ applied to a spatial vector field can be decomposed according to vector analysis into two parts

$$\Delta \mathbf{E} = \text{grad}\,\text{div}\,\mathbf{E} + \text{rot}\,\text{rot}\,\mathbf{E}$$

$$\Delta \mathbf{E} = \nabla(\nabla \bullet \mathbf{E}) + \nabla \times \nabla \times \mathbf{E}$$

Now we look at the right side of the equation. The speaker explains that the first term represents a scalar wave and the second term represents a transversal wave, or more precise, the first term has a scalar part and the second term has a vector part. With this equation the co-existence of longitudinal scalar waves together with transversal vector waves in electromagnetic radiation is founded[7].

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Electromagnetic Waves

In the year 1888 Heinrich Rudolf HERTZ[2]-[4] has proofed by experiments, that an electric resonant circuit can transfer energy to an other distant resonant circuit without a connecting wire. The most famous apparatus is the HERTZ dipole. For theoretical calculation of the Hertz experiments no wave equation is needed. The author[20] has shown, that is sufficient to add all forces of the charges involved somehow in the transmitter to a distant stationary charge in a receiving to calculate the experimentally found data. There are in first approximation three force parts[20]:

- **proportional to $1/r^3$** caused by ***resting*** charges,
- **proportional to $1/r^2$** caused by ***moving*** charges and
- **proportional to $1/r$** caused by ***accelerating*** charges.

In addition the different wave characteristic is given as:

- **proportional to $1/r^3$** have transversal and longitudinal parts,
- **proportional to $1/r^2$** have transversal and longitudinal parts and
- **proportional to $1/r$** has only a transversal part.

For some conditions of frequency and current density in the antenna the (ball shaped) terminals (charge reservoirs) at the end of the antenna can be dropped, as it is mostly done today. Then the transmitting antenna only consists of one or two wires. The optimum frequency is determined by self induction and self capacity of the antenna. Now, figure 1 shows the difference between the transversal and longitudinal force parts on a distant charge:

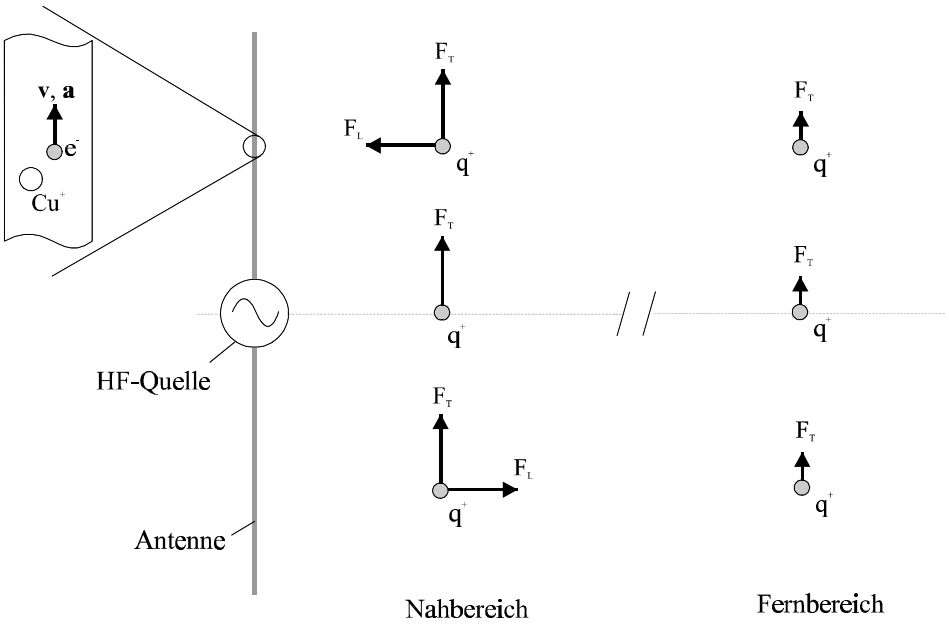

Figure 1: Force of a transmitting antenna on a distant test charge q^+.
(HF-Quelle = high frequency oscillator; Nahbereich = near distant area; Fernbereich = far distant area)

The charge q^+ is a free conducting electron in a receiving wire, for example. The longitudinal forces F_L on the test charge q^+ caused by the moving electrons in the transmitter cancel each other out in large distances, but not the transversal forces F_T, which add each other. They

diminish with distance of course. In the receiving antenna an oscillation of the free conducting electrons of the same frequency as the transmitting oscillator but with an amplitude proportional to the inverse of the distance can be detected now, if the receiving antenna is oriented parallel to the transmitting antenna. But if the receiving antenna is oriented perpendicular to the transmitting antenna, no force on the conducting electrons can be detected in far distances (if there are no reflections due to other bodies, of course).

If the force is imagined as a wave, then we can say, that in far distances only the transversal wave can cause an effect but not the longitudinal wave. Figure 2 shows this again.

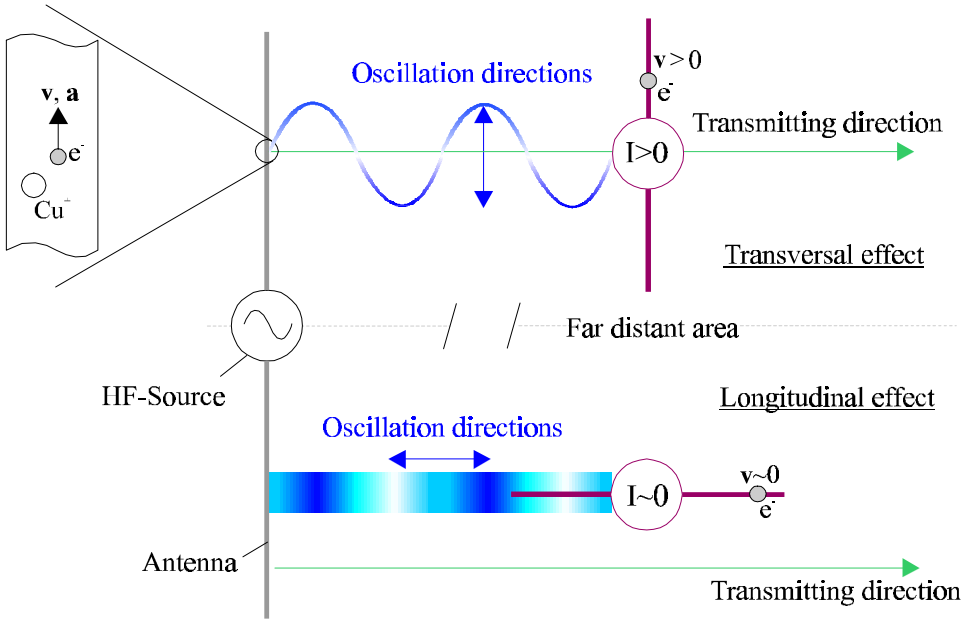

Figure 2: Difference of transversal and longitudinal effects of a HERTZ transmitting antenna to a far distant charge q^+.

As shown[19] the forces between charges are important for calculation of this problem. But this can be applied to the whole physics, then in every experiment known by the author at the very bottom end only forces between charges are measured. Everything what happens in-between this charges and how this forces are communicated is subject of different physical models, which probably do not have many things in common with that, what really happens (An example: never a photon has been observed but only a quatisized movements of a charge, which is then interpreted as a photon interaction.)

The term „wave“ can for example only be applied to a thing which is able to oscillate. And for that an inertia is necessary then without inertia an oscillation is certainly not possible. But how should an „empty“ space (vacuum) be able to transmit waves without a medium (aether)? Therefore we have to restrict us mainly on the measurable force laws, and must always have in mind, that the different answers to the question, how this forces are transmitted, uses physical models only.

The force of a Hertz dipole on a charge in great distances is in close approximation equal zero, what means, that no far reaching longitudinal forces are expected. An other thinkable construction of a transmitter is a single oscillating charge (similar to a first order sound wave transmitter). *But unfortunately it was never possible to build a single electric charge oscillating*

in time. This is the law of the conservation of charge. And for this reason every transmitter consists at least of two opposite polarities which are mutually charged and recharged. Therefore each antenna has two opposing charged poles which are changing in time. But everywhere we have two opposing charged poles the longitudinal forces of this poles on an other charge having the same distant to both poles are canceled out perfectly. Only the transversal forces can "survive" this cancellation in far distances.

The statement of the speaker, that the longitudinal waves can propagate much faster than the transversal wave (which always propagate wit the speed of light) can not be understood on the basis of the presented wave equation. From this equation we can rather say that all wave parts – therefore also the longitudinal parts – have the same speed. If the longitudinal wave would be propagated with an other speed than the transversal wave, then not both parts can be co-exist in the same wave equation but both parts would require their own independent wave equation.

Arrangement of the MEYL Experiment

The arrangement can be seen in figure 3. A high frequency signal generator supplies with a conductor of length ~0.5 meters two anti-parallel connected light emitting diodes (LEDs) and the transmitter's primary coil. One terminal of the transmitter's secondary coil is connected to a ball electrode (aluminum foil on a polystyrene sphere, $\varnothing \approx 6$ cm), the other terminal is connected to the bottom of a FARADAY cage. This FARADAY cage consists of an electric conductive screen (screen with ~0.5mm) wrapped around a wooden frame. The transmitter and receiving transformers are without a magnetic core (air coupling). The windings are made with isolated wires on a cardboard cylinder. Both transformers including the spheres are of equal size and made with a high symmetry.

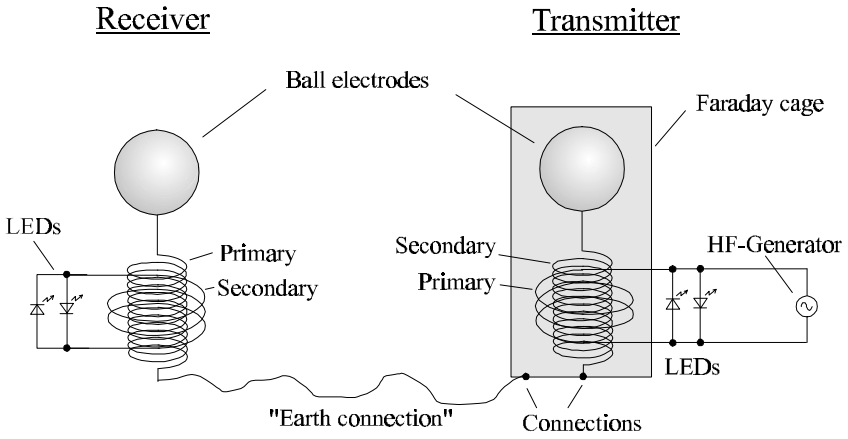

Figure 3: Arrangement of Meyl's experiment presented in Bregenz (Austria)

The bottom of the FARADAY cage is electrically connected with one end of the receiver's primary coil. In analogy to TESLA's patents we call this connection the „Ground connection". The other end of the receiver's primary is again connected to a sphere of the same size. Finally on the receiver's secondary coil a load consisting of two anti-parallel connected LEDs is connected. Other estimated parameters are:

f:	Frequency of HF-Source:	3.9 ± 0.1 MHz (Range according digital display)
a	Distance between spheres:	4 m (estimation)
l:	Length of „Earth wire“:	6 m (estimation)
n:	Number of windings (inner coil)	30 (estimation)
d:	Coil diameters	6 cm (estimation)

Experimental Runs

1) The HF-Source is switched on and tuned to an „average“ frequency of 3.9 MHz. Then the LEDs on the receiver and transmitter glow approximately with the same brightness.
   Scalar wave hypothesis: The transmitter and the receiver are tuned to each other. An energy exchange (with scalar waves) takes place from the transmitter to the receiver.

2) The frequency is lowered to about 3.8 MHz until the transmitter‘s LEDs are glowing only, but not the receiver‘s LEDs.
   Scalar wave hypothesis: Transmitter and receiver are out of phase. No energy transmission takes place, i.e. the receiver does not get any power.

3) The frequency is tuned upwards to about 4.0 MHz until the receiver‘s LEDs glow, but not the transmitter‘s LEDs.
   Scalar wave hypothesis: Transmitter and receiver are coupled ideally. Now an energy gain (over-unity) takes place, i.e. the receiver gets more energy via scalar waves (origin?) than is supplied by the transmitter.

4) All presented effects do not diminish if a FARADAY cage is placed over the sphere of the transmitter.

5) If now the “Earth wire” is cut off, then the Receiver’s LEDs stop glowing but the transmitter’s LEDs does again not glow.
   Scalar wave hypothesis: There is no resonance so that the receiver does not get any energy.

With some people from the audience and with Konstantin MEYL the author has made an other run after the presentation. The following has been checked:

6) Again the configuration 3) is set up. Only the receiver‘s LEDs are glowing. Then the receiver is moved on a flat cardboard away from the transmitter of about one meter, i.e. the distance between the two spheres increases from 4 to 5 meters (but not the length *l* of the „Earth wire“). Result: The intensity of the LEDs glow does not change, neither on the receiver nor on the transmitter. The result does not depend from a change of distance of about 20%.
   Remark: The intensity of the LEDs glow changes dramatically if the receiver’s transformer is touched by hand (or better enclosed by hands). This does not depend of the distance of the touching person relative to the transmitter.

Comments from Author‘s Standpoint

The arrangement of the experiment comes very close to the classic HERTZ dipole:

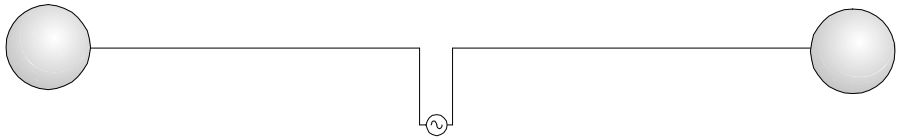

Figure 4: HERTZ dipole

The experimental set-up can be re-drawn to show the situation:

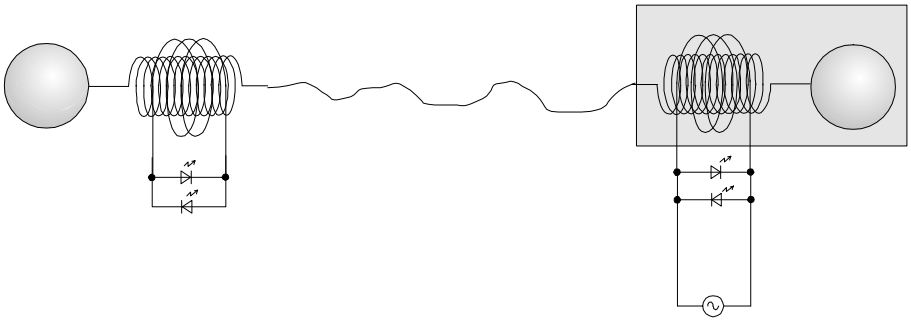

Figure 5: Re-drawn arrangement but with the same electrical circuit

The HERTZ dipole pumps charges (electrons) between the two reservoirs (spheres) back and fourth. As commonly known electric waves are emitted due to this charge acceleration.

Both transformers in Meyl‘s experiment have two functions. One serves to impress a current into the connecting wire („Earth wire“) between the spheres, the other serves as a kind of detecting coil to measure the current along the connecting wire. We can draw the following diagram:

Figure 6: Simplified Diagram

After observing the experiment the author has some doubt if not the presented effects can be explained without the aid of radiation (either scalar or vector field radiation). At least two suggestions are possible.

Suggestion 1

An electric wave can be measured along the wire because of the finite speed of the transmission of the electric field. With a correct frequency tuning a standing wave can be obtained (principle of the LECHER conductor).

If at one position the LEDs are exactly at a wave knot, no glowing can be observed whereas at an other position the LEDs may glow. This suggestion is able to explain the experimental results 1) to 6). But if we now look at the wave lengths used in the experiment, we find:

$$\lambda = \frac{c_{CU}}{f} \approx \frac{c}{f} = \frac{3 \cdot 10^8}{3.9 \cdot 10^6} = 76{,}9 \text{ m}$$

as it has also been mentioned by the speaker. The wave length is far above the distance between the spheres or the length *l* of the „Earth wire". This is also the case if the total wire length including the windings of the coils are taken into calculation. The length of one winding is approximately $6 \cdot \pi = 21$ cm which gives an additional wire length of about 12 meters and a total wire length L of about 18 meters. Together with the length of the „Earth wire" only ~¼ of the wave length is reached.

To explain the effects according 1) to 6), it is necessary that the total conductor length L is equal to the wave length of the frequency shift (Δf of about 100kHz), and this wave length is even larger:

$$\Delta\lambda = \frac{c_{CU}}{\Delta f} \approx \frac{c}{\Delta f} = \frac{3 \cdot 10^8}{0.1 \cdot 10^6} = 3'000 \text{ m}$$

With the suggestion 1 it is not possible to explain the presented effects on the basis of standing waves along the wires.

It is now even possible to say for simplicity that the current density along the conductor length (and also the voltage drop per conductor element) is for a given time independent of the position along the wire. And the radiation characteristics of the dipole wires do have a very low influence to the experiment.

Suggestion 2

Due to symmetry both transmitter and receiver transformers do have resonant frequencies which are close together. This resonant frequencies are determined mainly by stray inductance and capacitance of the coils.

Now the following circuit diagram is valid (figure 7):

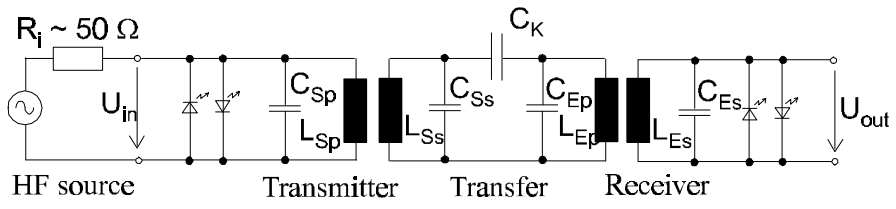

Figure 7: Circuit diagram of MEYL's experiment; the ball electrodes build the capacity C_k

The transmitter and the receiver are built very symmetric and of the same size. The same materials have been used. It is therefore allowed to conclude that both transformers have more or less the same inductance and winding capacitance. The transmitter secondary's inductance L_{Ss} (and also L_{Ep} of the receiver's primary) can be estimated as to be 30µH. If we suppose the winding capacities C_{Sp} and C_{Ep} to have the value of ~60 pF, then the resonant frequency of the windings are about 3.75 MHz. Analogue calculations can be done for all the other stray inductances and capacitances which gives even more possible resonant frequencies.

The voltages U_{in} and U_{out} depend now on the frequency and on the OHM'ic losses. Close to resonance they increase rapidly and gain above a certain voltage where the LEDs start glowing.

Because both transformers and also their load is not totally equal, it is very likely that both resonances lie close together but are not exactly equal. A difference of 200kHz in relation to 3.9 MHz for example gives a deviation of about 5% to each other. Then the following figure 8 shows a possible behavior of the resonances:

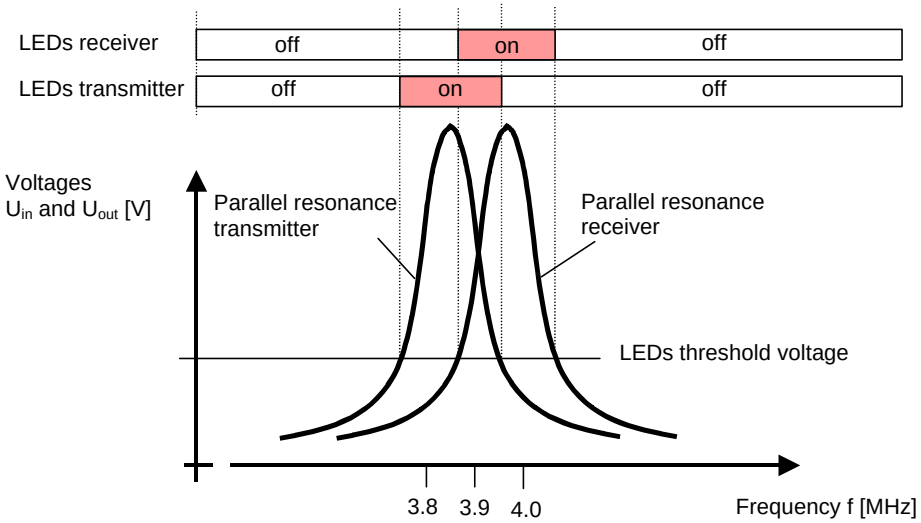

Figure 8: Dependency of the LEDs glowing on the frequency of the HF source.

The frequency of both coils are slightly different. Therefore with correct adjusted amplitudes it is possible that the LEDs glow on one transformer side only, on both sides together or even not, depending only on the applied frequency.

The suggestion 2 is able to explain all points 1) to 6) of the experimental results without an introduction of a scalar wave hypothesis.

The conclusion, that an arrangement similar to the HERTZ dipole is operated with resonant transformers having near resonances is sufficient to understand the experiment. The use of radiating waves has never been necessary for explanation. And because the spheres do not have a great influence (almost no radiation) also a FARADAY cage does not influence the outcome of this experiment.

Additionally the observation 6), that an enclosing of the transformers by hands does obviously influence the winding capacity and therefore shifts the resonant frequency, can be understood with this suggestion 2.

About the spheres

a) The experiment shows a frequency dependent behavior but no influence of the distance of the spheres. Therefore the distance is not essential for the correct operation of this apparatus.

b) The FARADAY cage does not influence the experiment.

c) The speaker has argued that the arrangement can be operated even without this spheres – but with a lower efficiency.

From this we can conclude that the geometry of the electrodes does not have a mayor influence to the experimental results. This is in line with the suggestion 2 but it does not support the scalar wave hypothesis. Then with waves it would be expected that the distance and the geometry of the spheres does influence the results especially when they are as close together as shown.

Reproduction of the Experiment

The author has duplicated the experiment as close as possible. Three different pairs of transformers has been tested without previously examine (complicated) calculations for optimization. The following transformer pairs has been used (isolated copper wire Ø1mm and Ø0.5mm winded on plastic cylinders):

a) N_1 = 42 Wdg. on plastic Ø 5cm;
N_2 = 30 Wdg. on plastic Ø 5cm (fixed winded coils on the same plastic cylinder)

b) N_1 = 42 Wdg. on plastic Ø 5cm;
N_2 = 120 Wdg. on plastic Ø 4.5cm (the coils can move freely against each other)

c) N_1 = 10 Wdg. on plastic Ø 14cm;
N_2 = 10+5 Wdg. on plastic Ø 14cm (fixed coils on the same plastic cylinder)

With all transformer pairs an energy transmission has been detected with the first runs, so that with the right frequency two anti parallel LEDs has glowed on the receiver. The optimal energy transmission has taken place with the following different frequencies:

a) 850 kHz; 1.9 MHz and 18.7 MHz

b) 1.23MHz; 13 MHz (depends on the position of the freely movable coils)

c) 1.1 MHz

The ball electrodes have a strong influence on the amount of the transmitted energy but not on the resonant frequency itself. If the capacity C_K between the two spheres would have an influence then the resonance frequency would have to change – but it doesn't.

Instead of the aluminum coated polystyrene spheres of Ø 6cm also some copper plates with an area of about 400cm^2 have been used. They increased the transmitted energy even more, because there are now more oscillating charges available for the „Earth wire".

Then the current in the connecting „Earth wire" was measured. The measurement has been done with an oscilloscope measuring the voltage drop along a shielded wire potentiometer, which has been placed in series to the „Earth wire". The impedance of the potentiometer is not only real but also has in inductive part. This complicates the exact quantitative measurement but still can be used for qualitative measurings.

In this way for all three transformer pairs the current has been detected. The current has then shown the following behavior:

1) Proportional to the output voltage of the receiver's secondary coil (without LEDs).
2) (subjective) proportional to the LEDs brightness an the receiver's secondary (proportional to the RMS current in the receiver's secondary coil).
3) Proportional to the position of the potentiometer's position (i.e. proportional to the potentiometer impedance).
4) Proportional to the supply voltage of the HF generator.

With a sufficient high resistance the energy transmission has been reduced almost down to the level of always present stray fields. All this current measurements have proved that the main part of the energy is certainly transmitted through the wire. The energy transmission through air between the spheres was in this cases very small (or even zero).

All transmitter primary coils have shown different resonances, on which the HF generator voltage has dropped close to the LED threshold voltage. The replication, that the LEDs light on the transmitter side goes out was not achieved at the first runs. But this can be done by increasing the generator's output impedance or by a better tuning of the HF source amplitude. So this feature depends on the used generator but it can be arranged for many generator types.

Other Experiments

Jean Louis NAUDIN[9] in France has replicated an experiment of Stanislav and Konstantin AVRAMENKO[1] and published the results on internet. Here with a lower frequency of about 10kHz a high voltage transformer is operated which is connected with one single wire to a distant bulb filled with Xenon gas. In operation this bulb shows a bright light. This experiment comes close to TESLA's earlier patent[13] for lighting with high frequency currents and high voltages and it shows, that the energy transmission at least partly happens through the connecting wire.

Summary

The results of the Meyl experiment do not prove the existence of scalar waves because it can be fully explained with conventional knowledge and without the aid of electric, magnetic or electromagnetic waves in air.

A longitudinal particle wave instead of an electromagnetic wave can for some instances be taken into consideration, but for such low voltages are used as in the Bregenz experiment it is not very likely to happen. Also MEYL[6]-S.199 writes for example, that for the proposed conversion of electrons into electron-neutrinos a voltage above 512kV would be necessary.

The claim of a „wireless" transmission must be dropped then one conducting wire still was in use. A over-unity effect (i.e. higher average output power than average input power) is also not proven with this experiment because the real power has not been measured. For such a measurement the output power of the generator must be compared to the power on all involved LEDs, what has not been done.

More independent experiments must help to clarify, if the suggestion 2 is really true, or if there are other causes for the presented effects of this experiment, or if it is really a prove of the existence of electric scalar waves and of an over-unity energy transmission as Konstantin MEYL claims.

Closing Remarks

The author[18] is convinced that Nikola TESLA never has made a conductor-less transmission of electrical energy. Then according to his own words TESLA[16] has used the planet Earth as a conductor which can be used for alternating currents. The „Earth wire" of the above diagrams can now be replaced by the Earth itself. But to use the Earth as an electric conductor, its electrical resonance must be established what needs a certain amount of ignition energy. And this is one reason why the author can not really believe in the conclusions of Konstantin MEYL about the Bregenz experiment which does only use very low energies (and voltages).

If the applied voltages are chosen much higher, the air between the electrodes (spheres) becomes more and more an electrical conductor for alternating currents of high frequency. And TESLA[13] has used this already in 1891 for his lighting system and it has lead him to the construction of several different lamps partly filled with gases. This conductivity of gases for alternating currents of high frequency TESLA designated as a longitudinal wave, similar as an alternate current in a wire can be seen as a longitudinal wave of electrons. With sufficient high voltages and frequencies the air becomes a better conductor so that it is possible that less energy is transported through the wire and more and more energy through the (ionized) air. This TESLA has recognized. Because of this he planned his experiments[14] in the high lands of Colorado Springs at about 2000 meter about sea level, then with a lower air pressure the polarized air becomes a better conductor for alternating currents of high frequency. And because of this he has mentioned in a later patent the Earth as well as the atmosphere as a possible medium for the transmission of electrical energy. And because of this it is possible for sufficient high frequency that the transmitting wire can be made thinner without an increase of losses. The possibility of a reduction of the wire's diameter without increasing losses has also been confirmed by AVRAMENKO's experiments, as NAUDIN has reported.

The final conclusion is, that TESLA has understood his longitudinal wave as a real oscillation of electric charges (mostly in the gaseous or plasma state), whereas MAXWELL and HERTZ has described the forces between charges with the model of transversal waves. *TESLA's longitudinal waves describes a particle wave (or more precise: an oscillation of charges) of a real existence whereas the HERTZ'ian wave is a physical model to explain, how the energy of an oscillating circuit is radiated to other charges.*

As an example we can take the Earth's electrical resonance. There exists two different resonances. One happens in the atmosphere between the Earth surface and the Ionosphere and depends on the Earth's circumference and is ~7.9Hz. It is known as SCHUMANN-Resonance[11],[12]. The other resonance takes place in the Earth and depends on the Earth's diameter and is 11.8Hz. It is as the TESLA resonance[17]. This data can easily be found in TESLA's patents.

The really astonishing fact about TESLA's experiment is the experimental prove, that the signal velocity observed with the Earth's longitudinal resonance (standing waves – or more generally: forces – through the Earth) is very close to the speed of light in vacuum.

Acknowledgement

I like to thank Adolph SCHNEIDER for his suggestions to NAUDIN's experiments and Dr. Hermann WILD and Dr. Hans WEBER for their examination of the first manuscript. Especially I'd like to thank Dr. Konstantin MEYL, who with his work[5] really has given the impulse to take a closer look at the described topic herein.

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