

TESLA & COLD ELECTRICITY

🇬🇧 *- revised English version -*

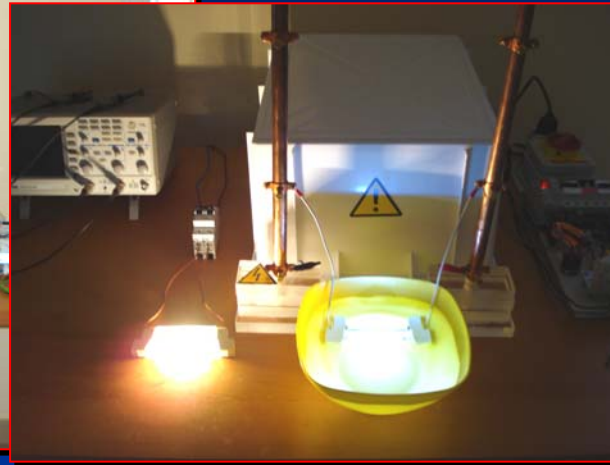
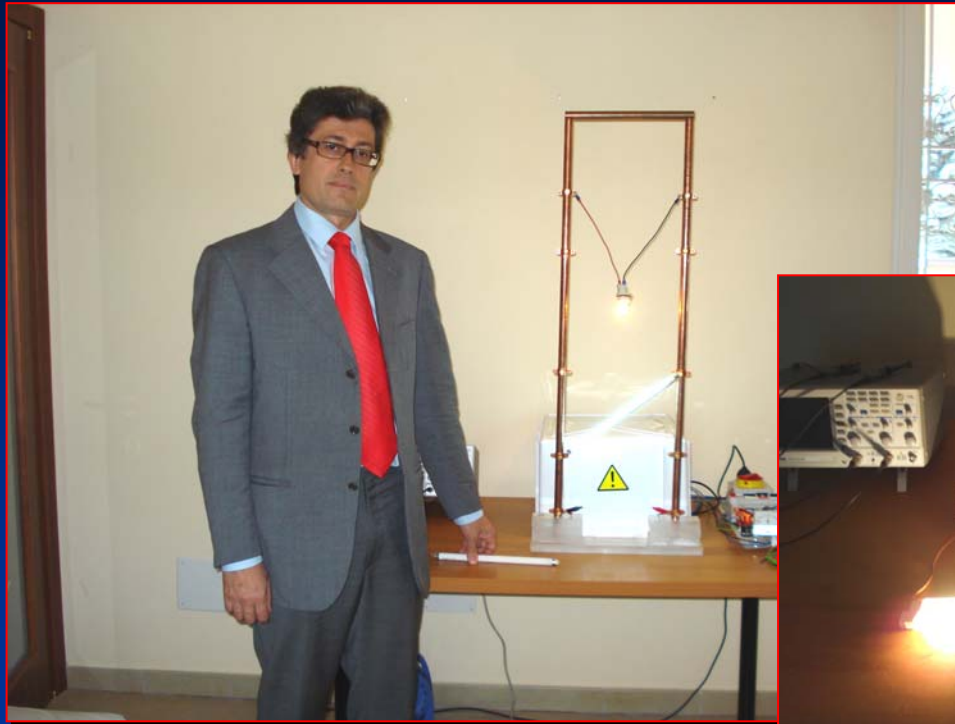


***Selected Tesla experiments replicated and
presented by***

Dr. Eng. Roberto Handwerker

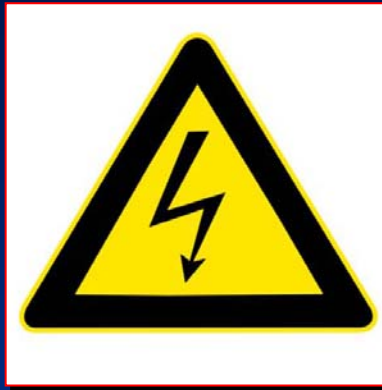
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Presentation



DELTA Ingegneria® of **engineer Roberto Handwerker**,
a consulting professional in advanced electrotechnics,
thermodynamics & energetics, also technical advisor to italian Judges

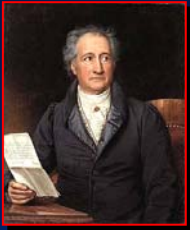
Disclaimer:



Warning !

- The following experiments make use of **electrical energy**: please **don't try to replicate them unless You are trained and well-experienced in electrotechnics**: the presence of high voltages and currents could cause You **serious injuring** and may even be **fatal** !
Replication of presented experiments or circuits at Your own risk !
- *However, the **shown experiments are verifiable and replicable** by someone who has the right means and know-how.*
- *The term "**Cold electricity**" is arbitrary, meaning only that the here **presented current effects are different from usual AC current ones.***

First some quotes...



“Each one sees what he carries in his heart.”

- Johann Wolfgang von Goethe (1749-1832)



“Every Truth passes through three stages. First, it is ridiculed. Second, it is violently opposed. And third, it is accepted as self evident”.

- Arthur Schopenhauer (1788-1860)



“Be silent, if you choose; but when it is necessary, speak - and speak in such a way that people will remember it.”

- Wolfgang Amadeus Mozart (1756-1791)



“The present is theirs; the future, for which I have really worked, is mine.”

- Nikola Tesla (1856-1943)

...and a few general notes

- Patient observation of **Nature** allows discovery.



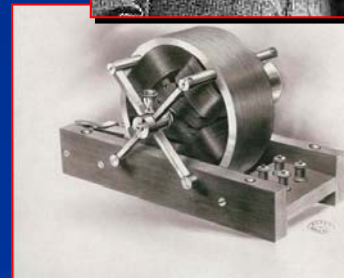
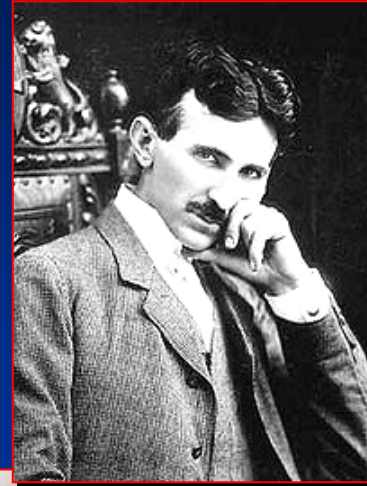
- Experiments were realised by use of **low-budget equipment**, small power laboratory apparatus, partially using scrap parts.
- **Electric field**: this term includes both **dielectric (ψ)** and **magnetic (ϕ)** fields^[5].
- **All construction and particular design** of presented Tesla-experiments apparatus **by DELTA Ingegneria®**.

Brief introduction to Dr. Tesla

“master of lightning”

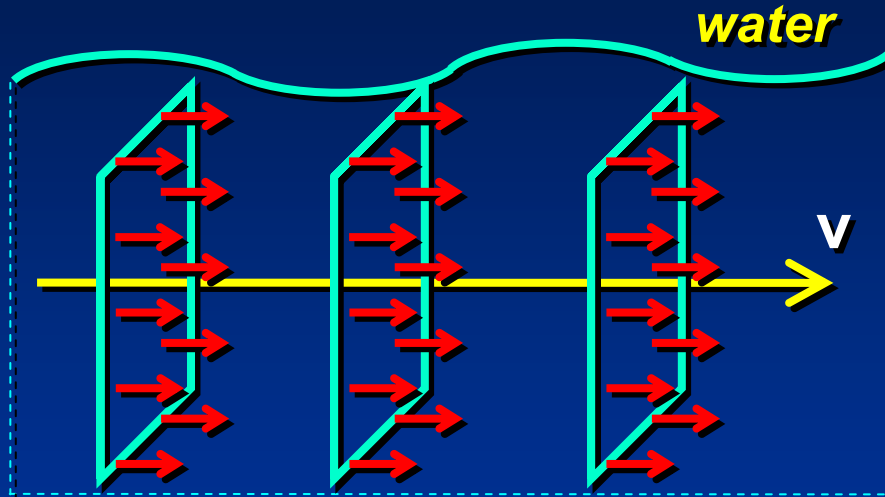
Nikola Tesla (1856-1943):
forgotten Serbian genius,
emigrant and later U.S. citizen,
great scientist, inventor and
philanthropist “invented” the
XX Century with his

- AC polyphase system
- AC induction motor
- Tesla turbine
- Radio apparatus
- More than 700 patents issued



Some Nature analogies from physics:

Ocean waves: surface waves, deep water pressure waves (tsunami)



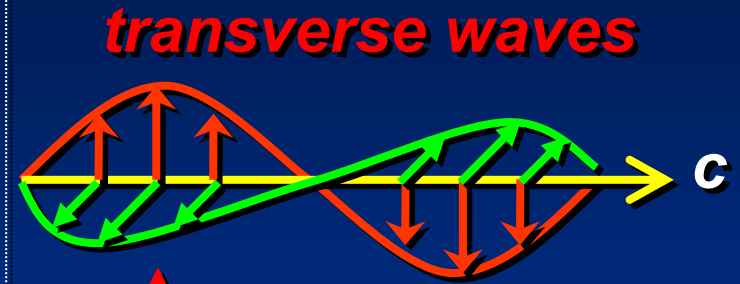
longitudinal waves



→ $x(t)$ oscillation

→ $v(t)$ propagation

oscillation parallel to propagation



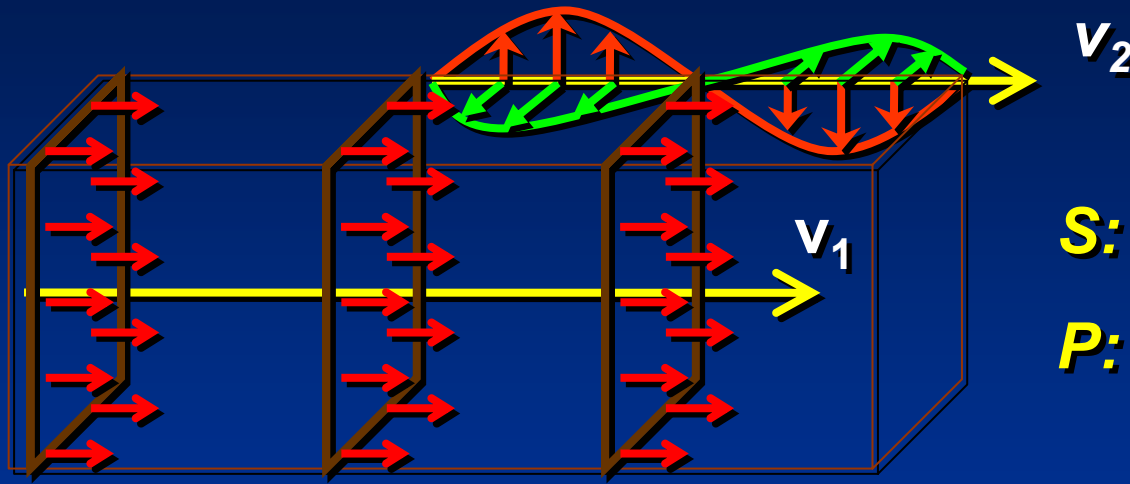
transverse waves

↕ $x(t)$ oscillation

→ $v(t)$ propagation

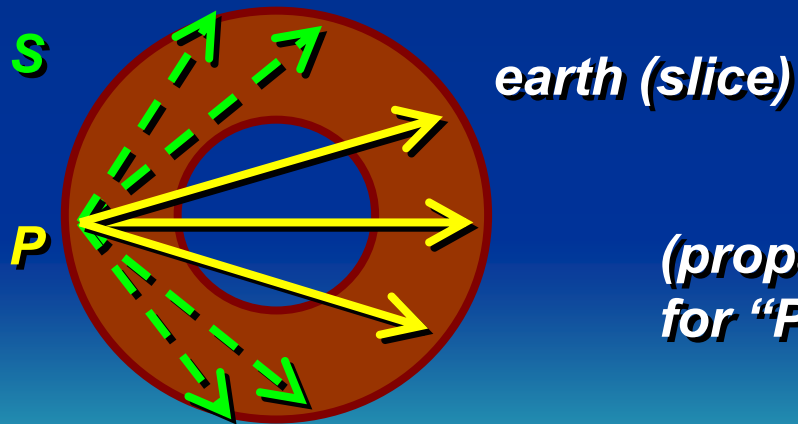
oscillation at right angles to propagation

Seismic waves: primary (P) and secondary (S) waves



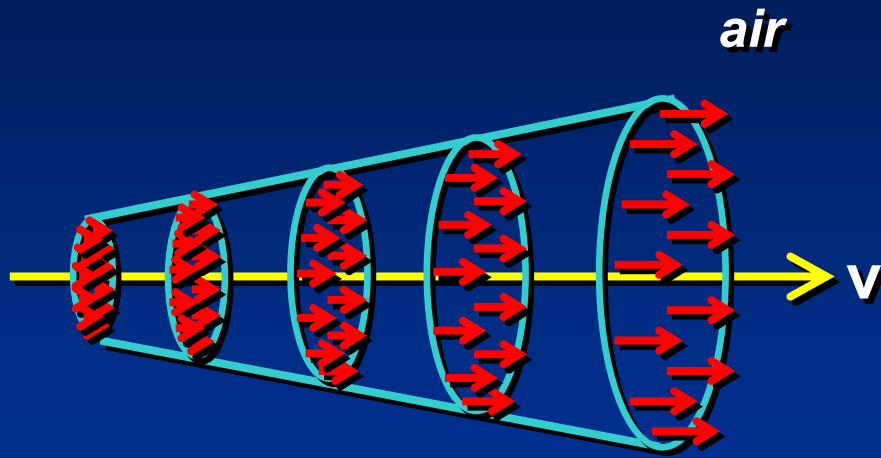
S: transverse waves

P: longitudinal waves



*(propagation through core only
for "P-waves" possible)*

Sound waves: *air pressure waves*



longitudinal waves

These analogies should be kept in mind during following experiments

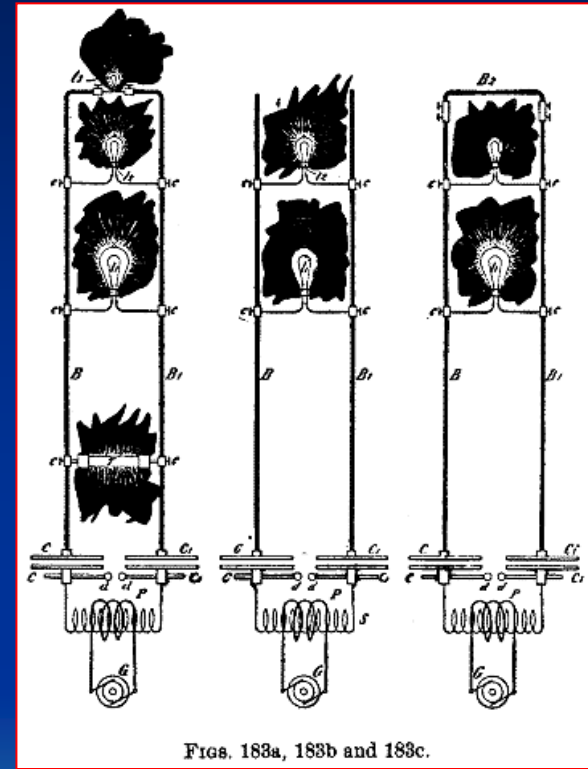
Let us begin with the experiments:

1) Tesla's "stout bars circuit"

- This experiment shows curious electricity phenomena, according to Tesla and also called "*Tesla currents*";

Application of Ohm's law

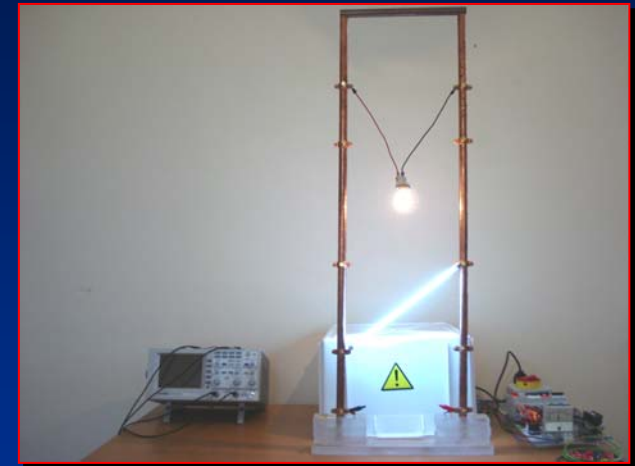
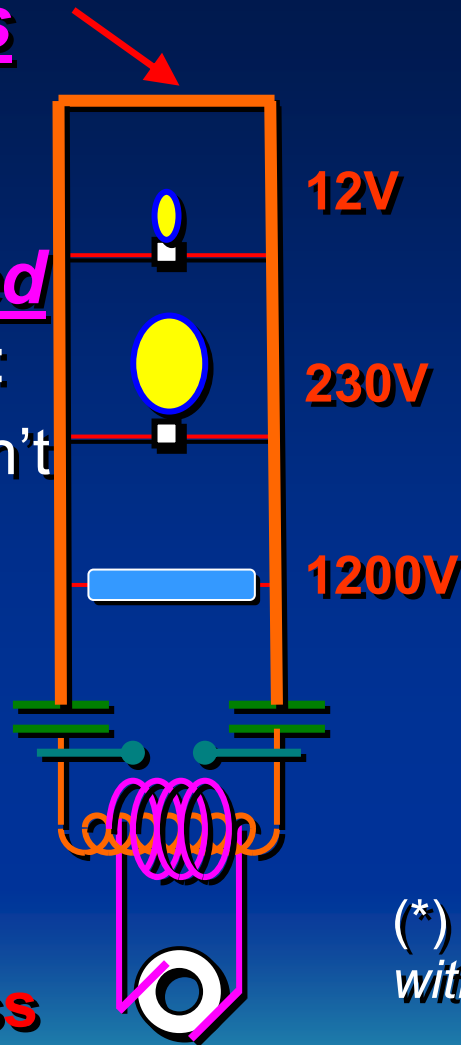
$v = R \cdot i$ to this case should be closely investigated.



Tesla's 1893 original circuit [2]

“Cold electricity”:

- The shunted lamps in the circuit light up at full brightness even with circuit shorted by a heavy copper bar:
- current evidently doesn't follow the bar path (smaller Ω) as normal, preferring the lamp filament (greater Ω).
- Lamps rated for different voltages work at full brightness at the same time (*)

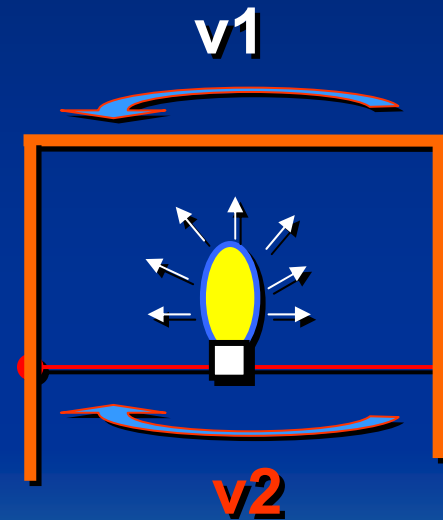
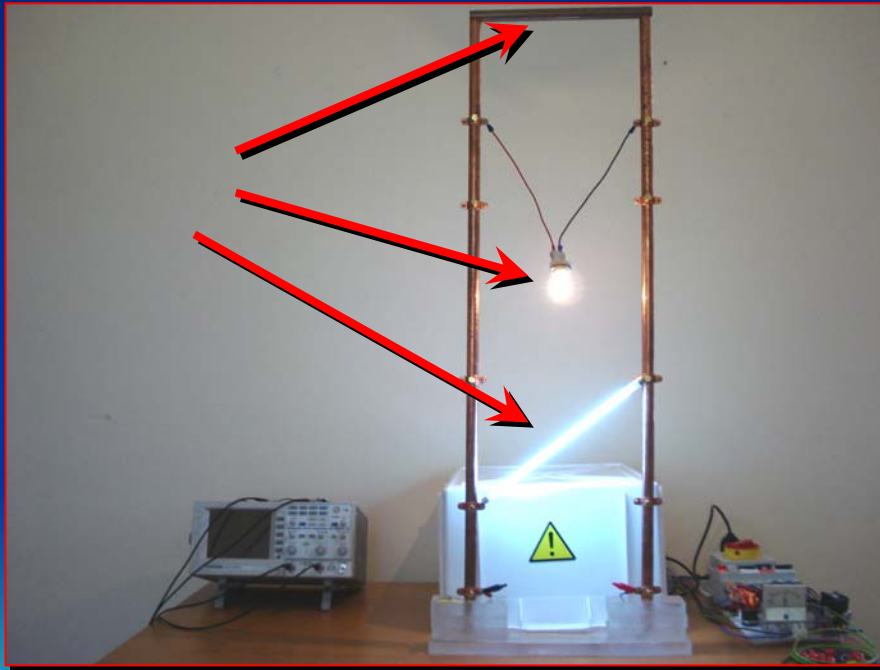


(*) The Neon tube lights up without usual “starter” circuit

Lamps work even if short circuited

- Ohm's Law: $v = R \cdot i$ ($v = Z \cdot i$)
- it should be $v_1=0$ and also therefore $v_2=0$

but it is evidently $v_2 \neq 0$ because lamp is fully lit

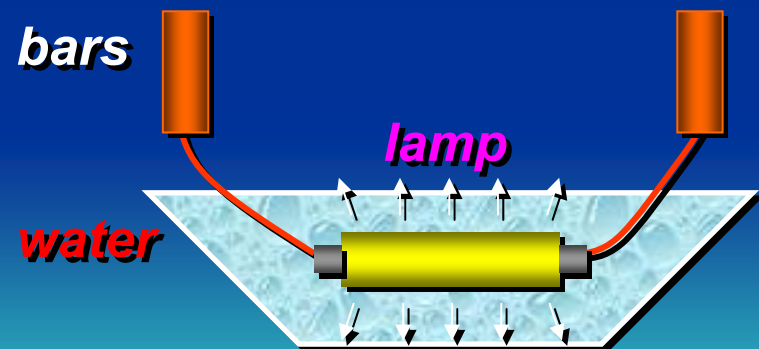
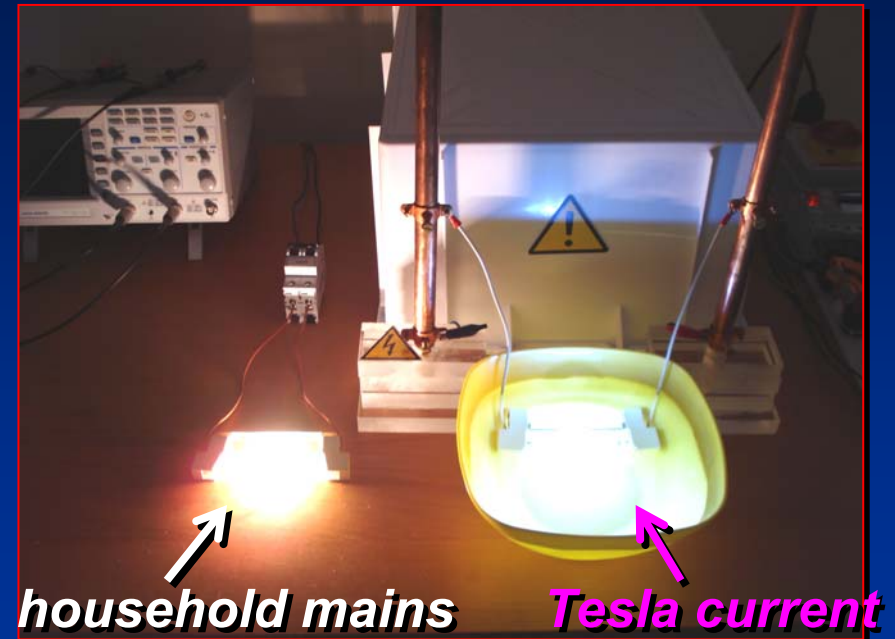


Halogen lamp lit immersed in water

A SPECIAL FEATURE by DELTA Ingegneria®:

- A striking effect is observed by shunting a lamp to the circuit (right) and **immersing it in water**: the 230V / 100W rated **lamp lits at its full brightness** (*); the same lamp type (left) is working by ordinary AC household mains (230V/50Hz, 1~); the emitted light colours are different: the left light is **reddish**, the right one **blueish**.

(*). some lamp types lit even with **broken filament**.

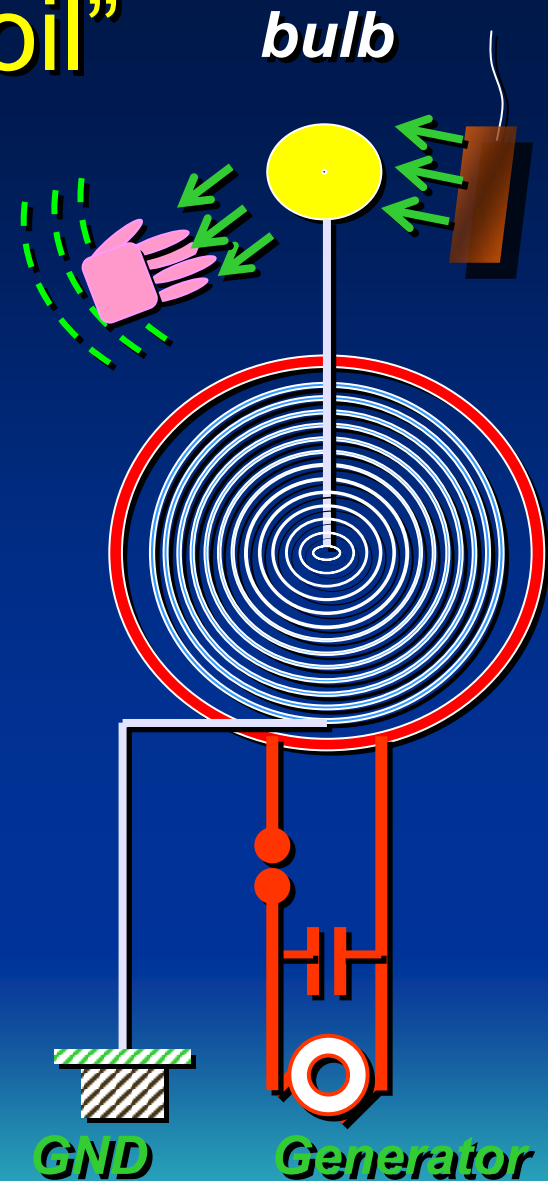


2) “Flat spiral Tesla Coil”

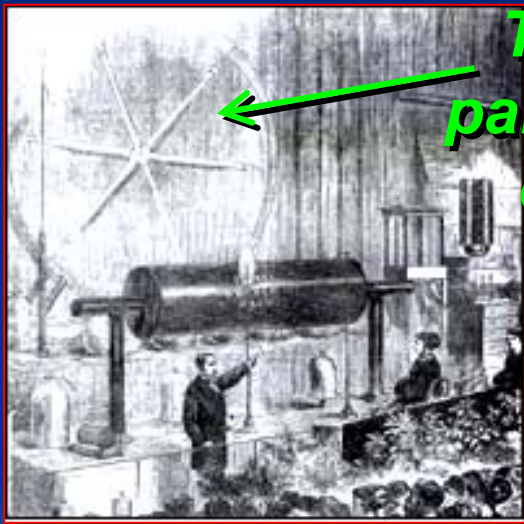
- A good Tesla’s flat spiral Coil (“pancake coil”)^[3] shows striking features:

lamp emits light and repels the human hand, but attracts a suspended metal strip:

- *The hand “feels” a kind of “pressure” coming from the lamp.*

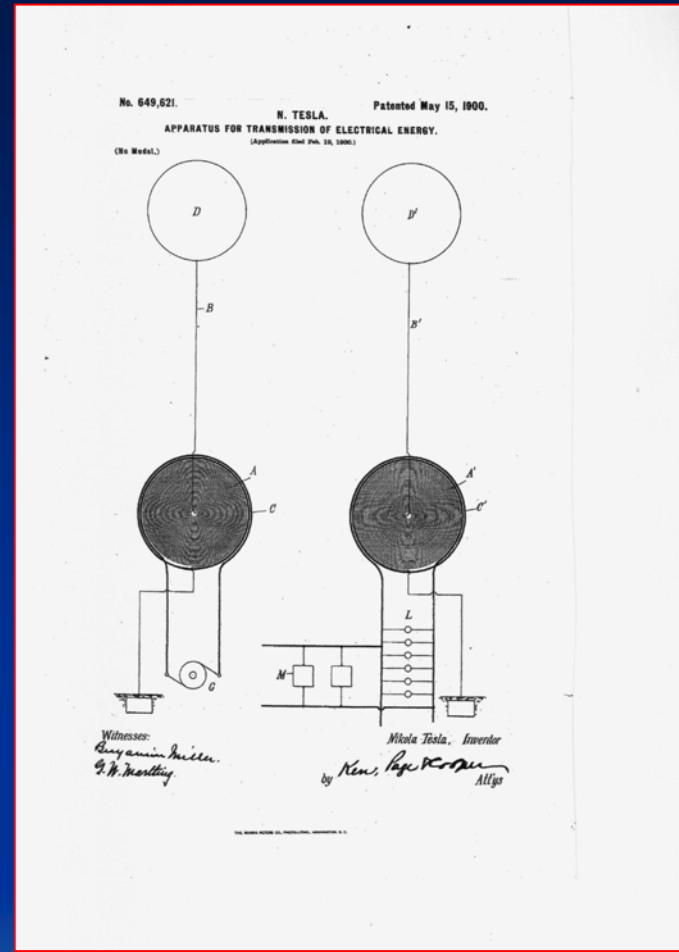


- **Tesla's 1900 original patent n.649621 for transmitting electrical energy;**



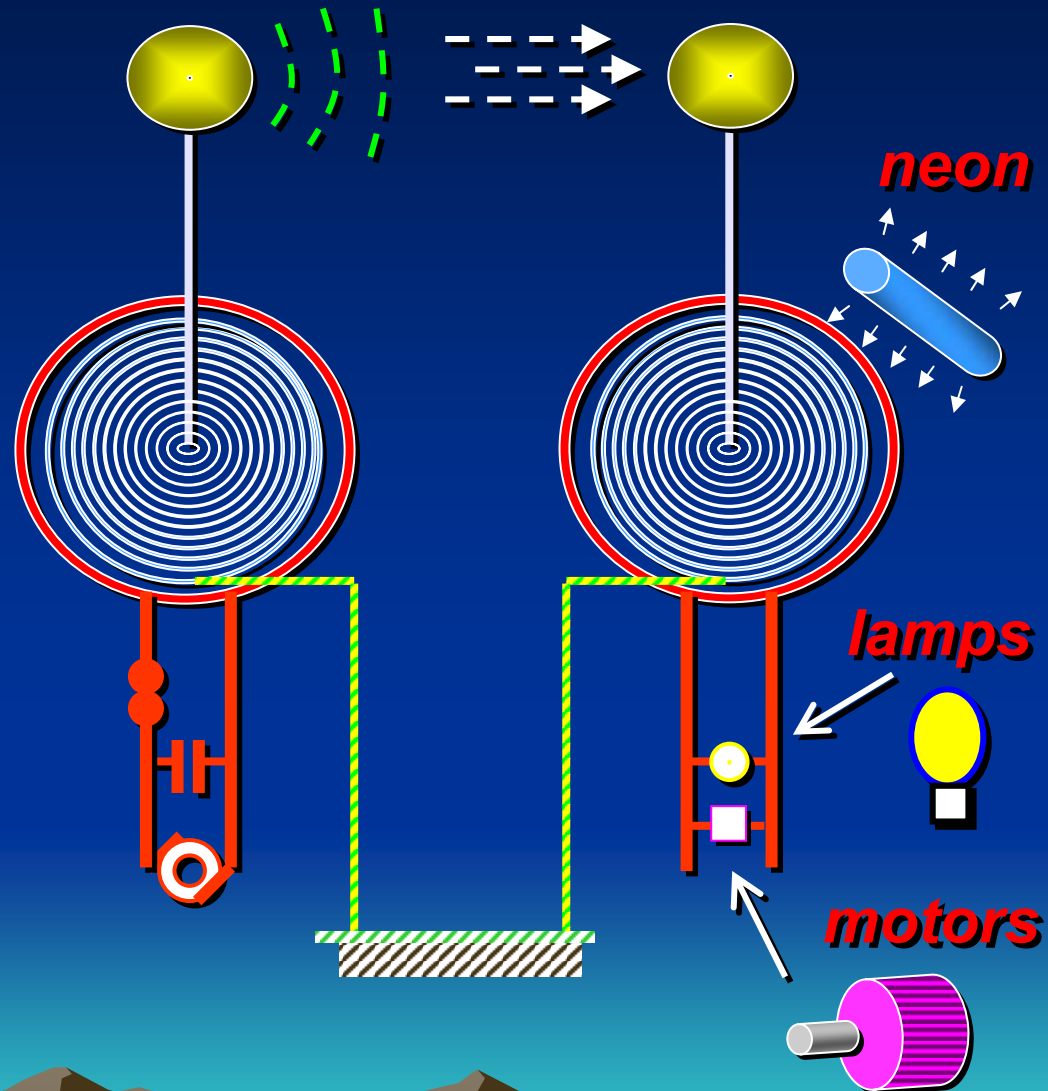
**Tesla
pancake
coil**

A Tesla lecture - about 1890

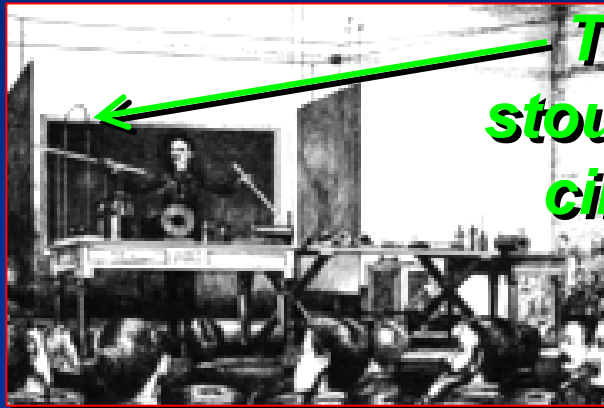


Transmission of energy with T.C.

- Art of transmitting energy in the medium (**ground**) by **ONLY ONE WIRE** and doing away with it, i.e. **WIRELESS:** a lamp on the second coil^[1] is lit and an electric motor runs

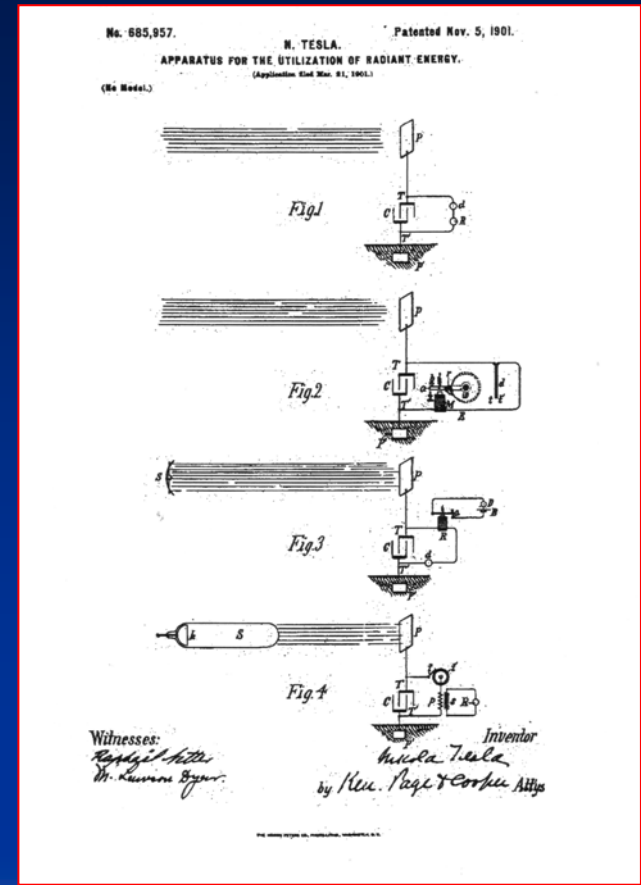


Tesla's 1901 original patent n.685957 for receiving ENERGY from a metal plate



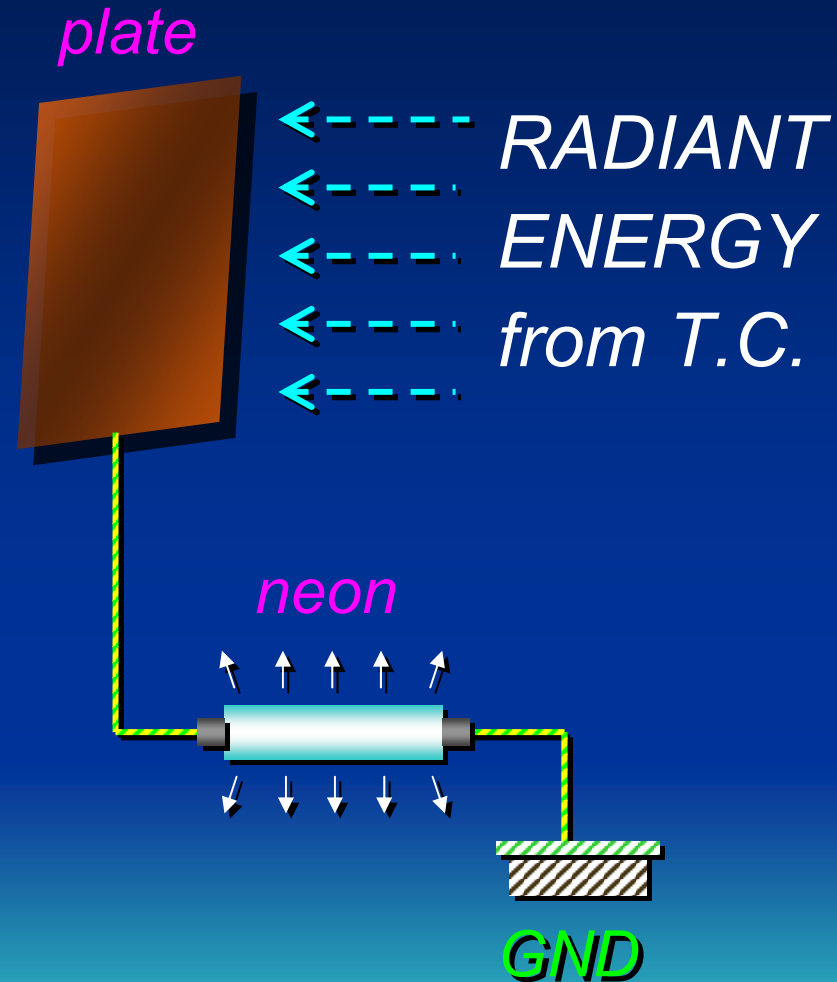
Tesla stout bars circuit

A Tesla lesson - about 1895



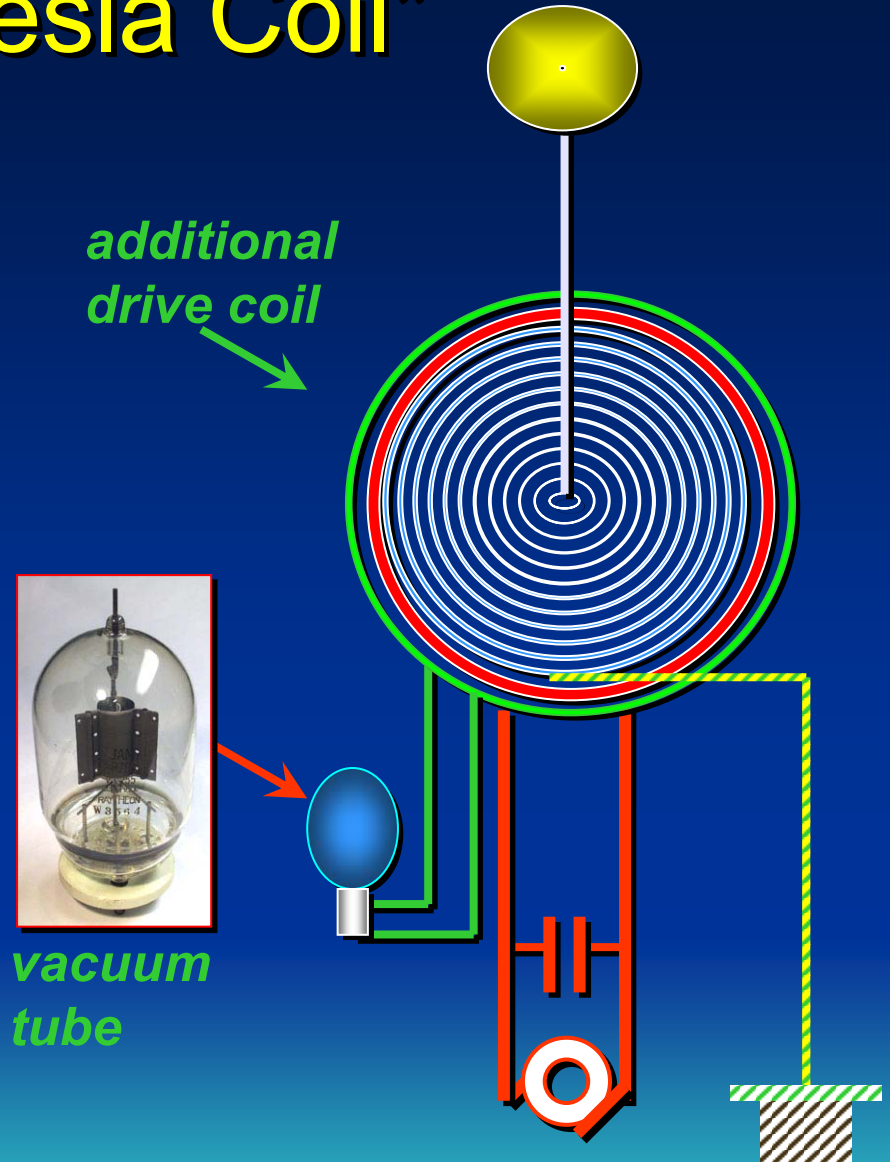
3) Utilizing electrical energy

- Apparatus for utilizing WIRELESS energy by an insulated plate and a series-connected-to-earth neon lamp (i.e. it transceives POWER, not only a weak *signal*)



4) "Vacuum tube Tesla Coil"

- A special **feature** from **DELTA Ingegneria[®]**: **flat spiral Tesla coil** energized by **vacuum tube** with an **additional drive coil** added to the primary, instead of the spark-gap.



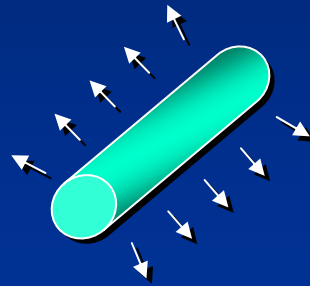
The energy field of a T.C.

- Tesla Coil's **energy field** lights up a neon tube to its full brightness without wires, that is

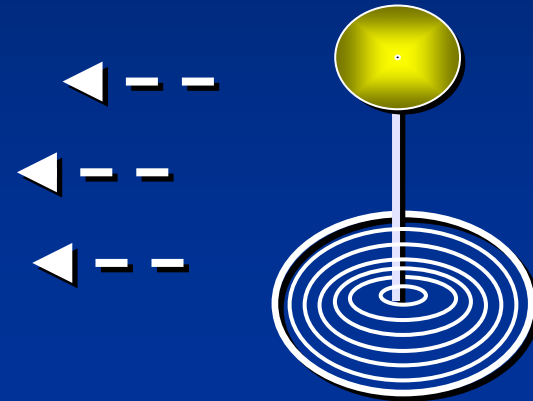
WIRELESS:

transmission of **ENERGY**, not only **signal**

power transmission



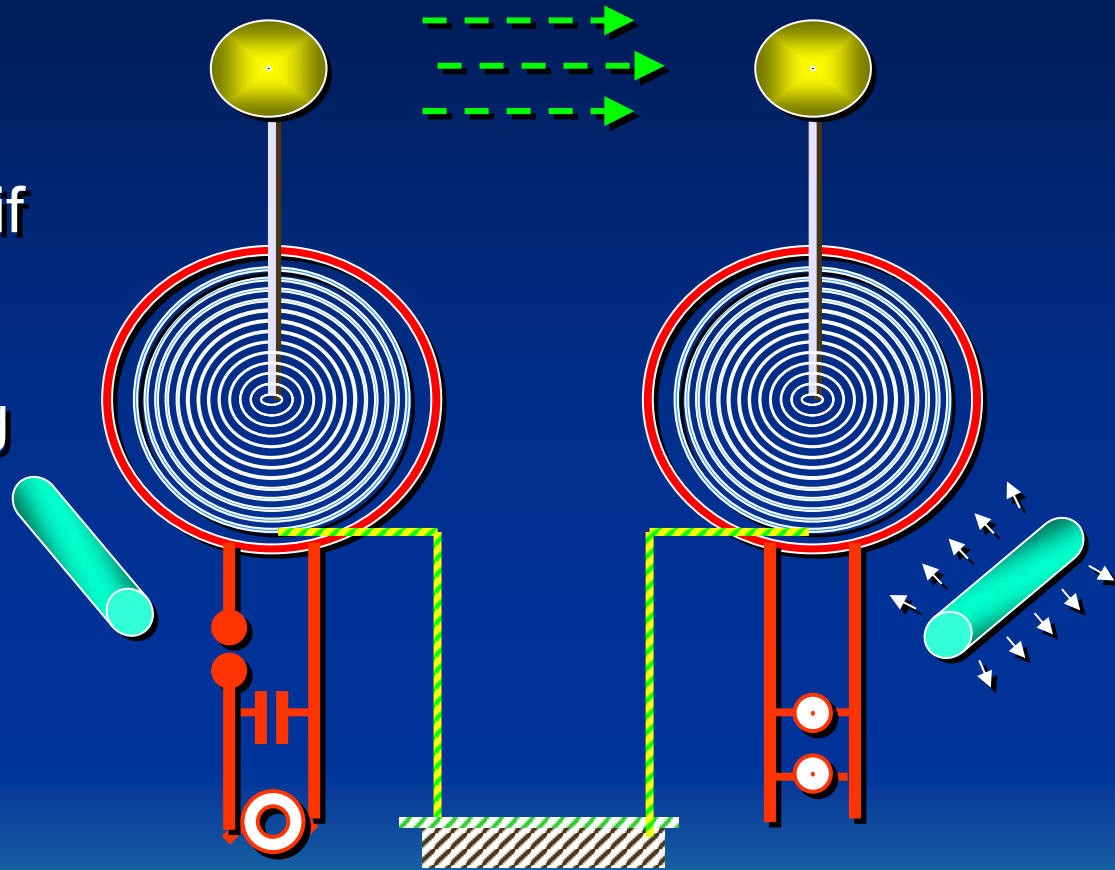
small power coil



MAGNETODIELECTRIC: is the “dual of ELECTROMAGNETIC”

5) Mutual effects between T.Coils

- **Mutual effects of XMTR and RCVR:** a neon tube near each Tesla coil shows that if RCVR coil is first switched **on** and then **off** the corresponding neon tube turns first **ON** and then **OFF** whereas the neon of the XMTR turns **OFF** and then **ON**.



The two T.C.s are communicating !

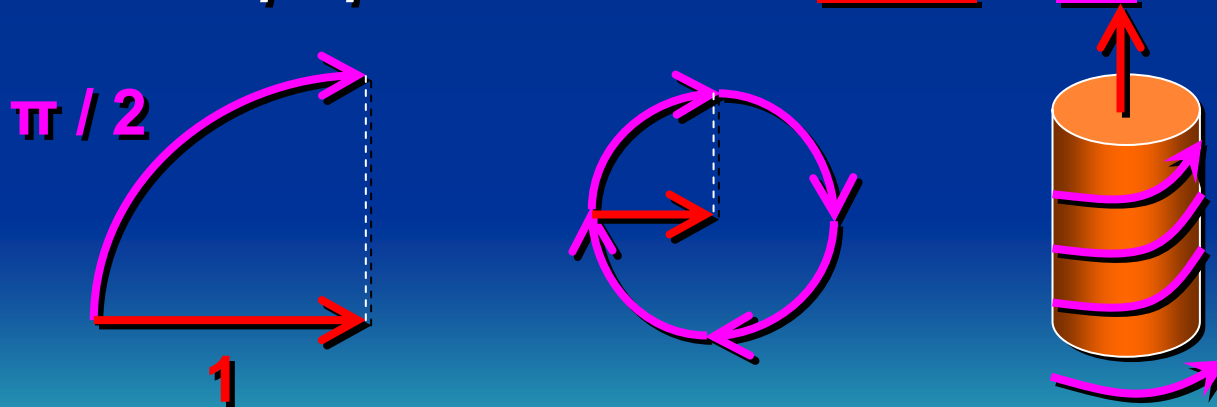
Tesla Coil resonance frequencies

- There are two different main resonance frequencies f_0 and f_1 , where $f_1 = 1,57 \cdot f_0$; for instance $f_0 = 1$ MHz and $f_1 = 1,57$ MHz; the relationship is therefore:

$$f_1 = f_0 \cdot \pi / 2 \quad (\pi = 3,141\dots)$$

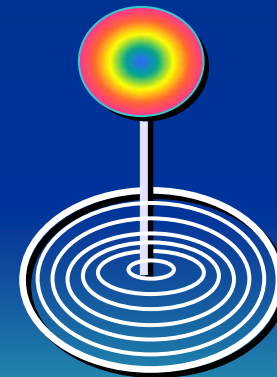
Frequencies relationship expressed by wave lengths λ :

proportional as circle radius to arc



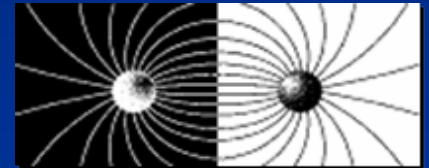
Light effects with a T.C.

- The apparatus produces **curious beautiful light effects, like brushes and streamers, in the lamp bulb at top terminal of secondary coil showing different colours** [1].



A few words about Maxwell's equations

- The original **quaternion** Maxwell's electromagnetism equations were later *modified* and *simplified* with the introduction of **vectors** by Heaviside and Gibbs”.
- Quaternions have **4** terms: $\mathbf{q} = a+bi+cj+dk$ (by Hamilton)
- Vectors have only **3** terms: $\mathbf{v} = ai+bj+ck$ (cartesian space)
- **Calculation rules are not the same in the two systems**, for instance:
 - Quaternions have anti-commutative property: $i.j = -j.i$
 - Vectors however have commutative property: $i.j = j.i$
 - The sum of quaternions $\mathbf{q1}=a+bi+cj+dk$ and $\mathbf{q2}=a-bi-cj-dk$ gives $\mathbf{q}=\mathbf{q1}+\mathbf{q2}=2a$ which is but **a scalar not equal to zero**
 - The sum of vectors $\mathbf{v1}=ai+bj+ck$ and $\mathbf{v2}=-ai-bj-ck$ gives $\mathbf{v}=\mathbf{v1}+\mathbf{v2}=\mathbf{0}$ that is **zero**;
in other words $\mathbf{q1}+\mathbf{q2}=2a$ but $\mathbf{v1}+\mathbf{v2}=\mathbf{0}$ as an example, so:
-> **results are not the same and so the involved equations**



Maxwell's equations in today's differential form are:

$$\nabla \cdot E = \rho / \epsilon_0$$

Dielectric flux theorem

$$\nabla \cdot B = 0$$

Magnetic flux theorem

$$\nabla \times E = - \partial / \partial t B$$

Faraday's law

$$c^2 \nabla \times B = j / \epsilon_0 + \partial / \partial t E$$

Ampère's law



where: E = dielectric field;

B = magnetic field;

ρ = charge density;

ϵ_0 = dielectric constant in vacuum;

$\partial / \partial t$ = time partial derivative;

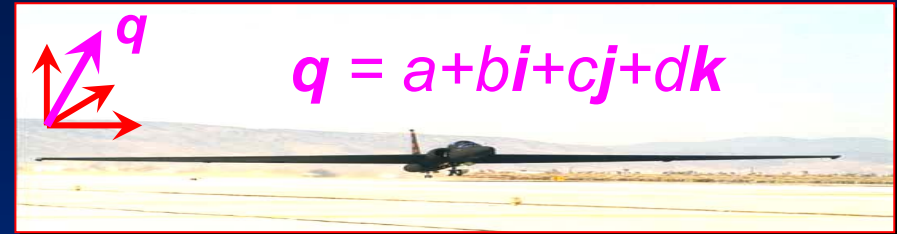
j = current density.

and "Lorenz gauge" would then arbitrarily fixed as: $\nabla \cdot A + 1/c^2 \cdot \partial / \partial t = 0$

but in 1865 originally J.C.Maxwell issued 20 equations

Quaternions, by use of Informatics, simplify complicated manual calculation and allow up to 55% memory space saving, for example in:

- computer graphics [6]
- aerospace navigation



Use of quaternions could be made in Maxwell's equations

- Moreover, two well known expressions of Maxwell's equations (where B and E are respectively magnetic and dielectric vectorial fields) are:

$$B = \nabla \times A$$

and

$$E = -\nabla \varphi - \partial/\partial t A$$

dielectric scalar potential φ and

dielectric vector potential A

Curiously they were often considered to be only mere mathematical abstractions rather than to have **physical meaning**.

- **God's creation is vast:** a lot has to be discovered.

"Flight by machines heavier than air is unpractical and insignificant, if not utterly impossible." - **Simon Newcomb, 1902.**



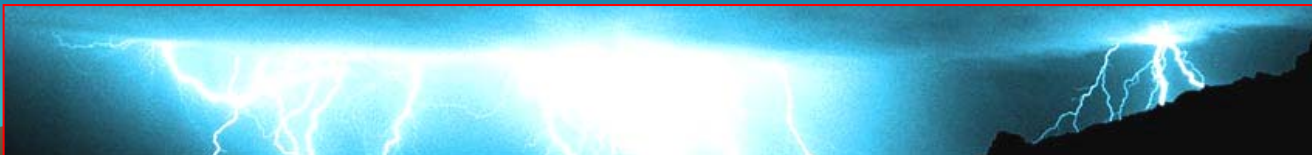
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Bibliography and references

- [1] Nikola Tesla: *“Experiments with AC of VHF and their application to methods of artificial illumination”*, 1891
- [2] Nikola Tesla: *“On light and other HF phenomena”*, delivered before Franklin Institute, Philadelphia, feb.1893
- [3] Nikola Tesla: *“The true wireless”*, Electrical Experimenter, may 1919
- [4] Hugo Gernsback: *“Faster than light !”*, Everyday science and mechanics - vol.2 n.12, nov.1931
- [5] Charles P. Steinmetz: *“Electric discharges, waves etc.”*, 1914
- [6] Roberto Handwerker et al.: *“Rotation of solids by quaternions”* for Elements of informatics, Milan Polytechnic, Faculty of Engineering, Milan, Italy, 1990



Thanks for Your kind attention !

Dr. Eng. Roberto Handwerker

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info:

info@deltaavalon.com

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also on website the author's article: "Tesla and cold electricity"

