Electrodynamics with Scalar Fields

and *Longitudinal* Electromagnetic Waves

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Electrodynamics with *Scalar* Fields

and *Longitudinal* Electromagnetic Waves

Presentation agenda:

- Scalar fields according to a very strict standard physics model
- Flaws in Classical Electrodynamics theory
- A simple way to fix some of the flaws
- A generalized Electrodynamics theory that includes scalar fields, to fix the flaws
- Experimental evidence for scalar electrodynamic fields
- Conclusions

The Higgs field is the *only* scalar field according to standard physics

Higgs boson

Mass energy: 125 Giga electron volt
spin 0 (scalar particle)
charge 0

The Higgs field is a scalar field. Its excitation, the Higgs boson, is very heavy particle that has spin zero and no electric charge. The Higgs field has an 'imaginary mass', it is *not* electrodynamic and it has no practical meaning.

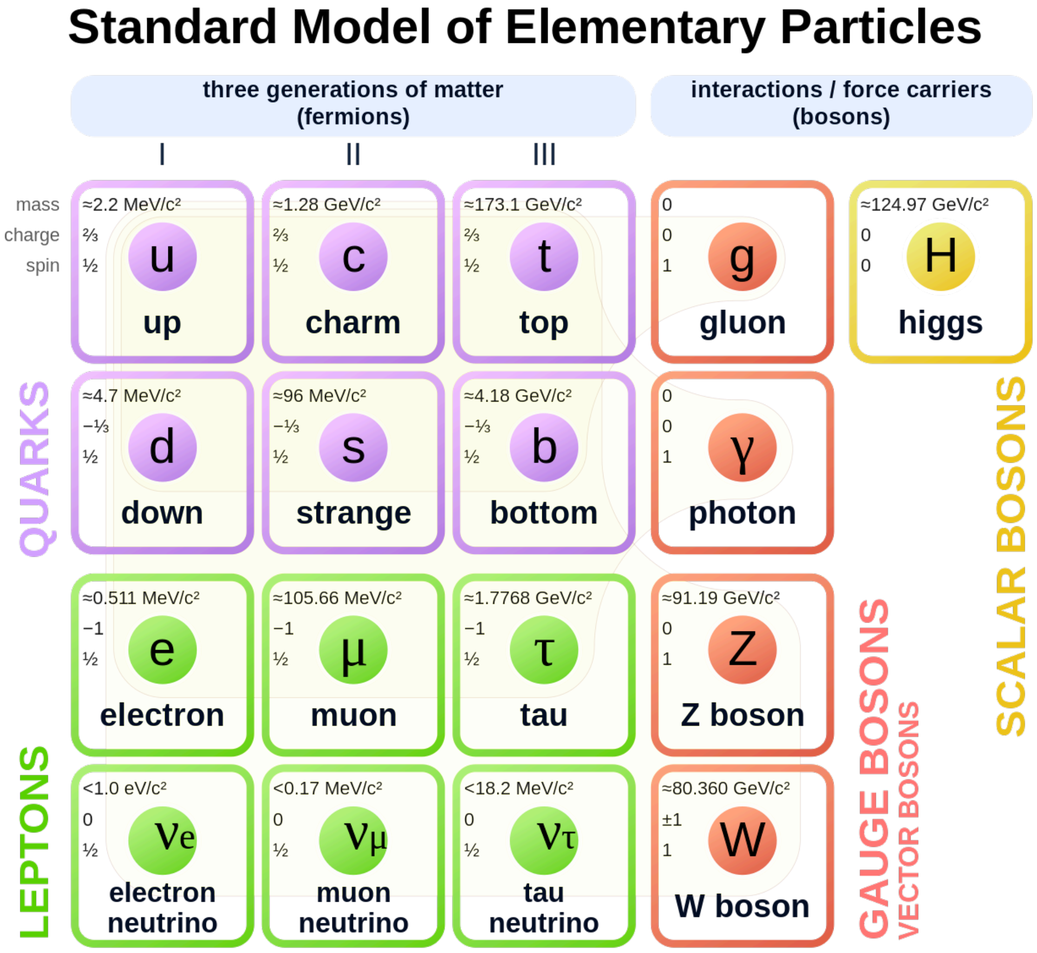
The Higgs theory/mechanism satisfies the following theoretical principles:

- it is a '*renormalizable*' gauge symmetry breaking of the U(2) gauge group
- it does not violate '*Einstein causality*' (no superluminal signals)

Renormalization is a mathematical technique for removing 'infinities' from calculations of physically measurable values in relativistic field theory.

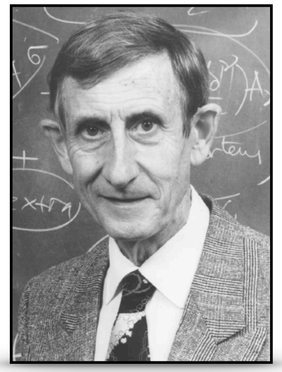
Superluminal means: faster than the speed of light in vacuum.

These two theoretical principles *rule out* the development of an *electro-dynamic* scalar field theory: "a symmetry breaking of U(1) results in photon mass, which is not observed". However, are these two principles even valid?



‘Renormalization’ was first applied in QED and QFT theory.

A closer look at the renormalization technique proves it is a meaningless concept.

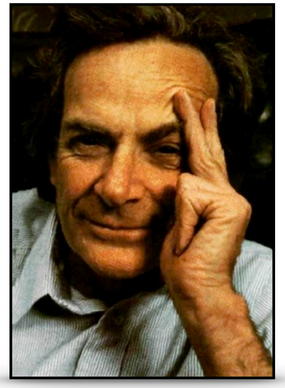


Freeman Dyson, No Nobel price for QED theory

Freeman Dyson, the principle author of QED theory, mathematically proved renormalization is pointless, see Dyson’s paper ‘*Divergence of Perturbation Theory in Quantum Electrodynamics*’. He concludes:

> *“All the power-series expansions currently in use in Quantum Electrodynamics are <u>divergent</u> <u>after</u> <u>the renormalization of mass and charge.</u>”*

The word ‘divergent’ means that QED theory predicts *infinitely high values* of physical constants, even *<u>after</u>* applying renormalization of mass and charge. This means that QED cannot be a valid physics theory, because it still predicts infinitely high values for measurable physical qualities.



Richard Feynman, Shared Nobel price for QED theory

Oliver Consa has studied the history of the ‘very high precision’ experiments about measuring the electron ‘g factor’, experiments that ‘verify’ the correctness of QED theory. In his paper ‘*Something is wrong in the state of QED*’ Consa concludes the following:

> *“It was evident that the QED calculations had matched the experimental data, because they were manipulated. The high precision predictions by QED theory of experimental data are based on fraud. Calculations based on Feynman diagrams are extremely complex, and were never published in their entirety, so these calculations were never validated independently.”*

This shows the renormalization procedure is meaningless for QED and QFT theory, so it is also meaningless for quark chromodynamics and for the Higgs theory. Renormalization is not an obstacle for deriving an *electrodynamic* scalar field theory.

Einstein causality was derived from ‘Special Relativity Theory’

‘Signals and particles do not travel faster than the speed of light.’

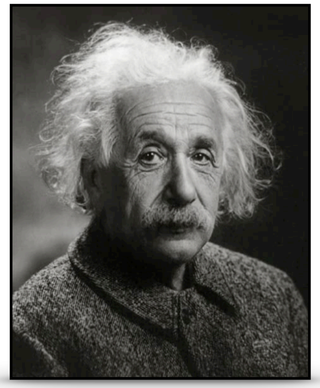
The following types of experiments falsify Einstein causality

- **Coulomb force propagation measurements**
  The Coulomb force appears to be an *instantaneous* force (much faster than light speed). This was concluded by Dr. Eugene Stefanovitch after examining fourteen different experiments to measure the *Coulomb force propagation speed*, see his paper ‘*Propagation speed of Coulomb force. What do experiments say?*’. Ten different experiments verified the hypothesis of an *instantaneous* Coulomb force. Notice that the Coulomb field (also called the ‘near field’) can carry information and signals from A to B instantaneously, which clearly falsifies Einstein causality.

- **Photon tunneling measurements**
  Photon tunneling experiments verified the reality of *superluminal* group-, signal- and energy velocities, see the papers by Günter Nimtz et.al.

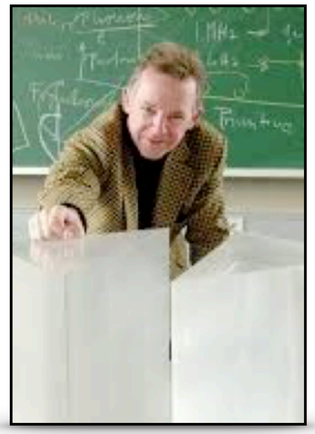
- **Electron tunneling measurements**
  Electron tunneling time interval measurements indicate that tunneling electrons have a superluminal velocity.

The superluminal speed of the Coulomb force is manifest on the microscopic scale, but also on the *classical macroscopic scale*. This means it is necessary to review the standard Maxwellian classical electrodynamics theory, which predicts a Coulomb force with velocity v=c, see the following slides.



Albert Einstein

Eugene Stefanovich



Günter Nimtz

Review of the Maxwell-Lorentz theory of classical electrodynamics

$$0 = \nabla\cdot\mathbf{J} + \frac{\partial\rho}{\partial t} \qquad \text{Charge conservation}$$

$$\mathbf{f} = \rho\mathbf{E} + \mathbf{J}\times\mathbf{B} \qquad \text{Lorentz force density}$$

Field definitions and gauge conditions:

$$\mathbf{E} = -\nabla\Phi - \frac{\partial\mathbf{A}}{\partial t} \qquad \nabla\cdot\mathbf{A} + \frac{\partial\Phi}{\partial t} = 0$$

$$\mathbf{B} = \nabla\times\mathbf{A} \qquad \nabla\cdot\mathbf{A} = 0$$

Maxwell's field equations:

$$\nabla\cdot\mathbf{E} = \frac{\rho}{\epsilon_0} \qquad \text{Gauss law}$$

$$\nabla\cdot\mathbf{B} = 0$$

$$\nabla\times\mathbf{E} + \frac{\partial\mathbf{B}}{\partial t} = \mathbf{0} \qquad \text{Faraday law}$$

$$\nabla\times\mathbf{B} - \frac{1}{c^2}\frac{\partial\mathbf{E}}{\partial t} = \mu_0\mathbf{J} \qquad \text{Ampère law}$$

Jefimenko's general field solutions:

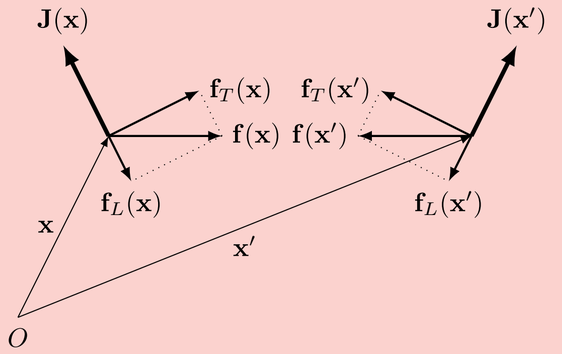
$$\mathbf{B}(\mathbf{x},t) = \frac{\mu_0}{4\pi}\int_{V'}\left[\frac{\mathbf{J_t}(\mathbf{x}',t_c)\times\mathbf{r}}{r^3} + \frac{\dot{\mathbf{J}}_\mathbf{t}(\mathbf{x}',t_c)\times\mathbf{r}}{cr^2}\right]d^3x'$$

$$\mathbf{E}(\mathbf{x},t) = \frac{1}{4\pi\epsilon_0}\int_{V'}\left[\frac{\rho(\mathbf{x}',t_c)\mathbf{r}}{r^3} + \frac{\dot{\rho}(\mathbf{x}',t_c)\mathbf{r}}{cr^2} - \frac{\dot{\mathbf{J}}_\mathbf{l}(\mathbf{x}',t_c)}{c^2r} - \frac{\dot{\mathbf{J}}_\mathbf{t}(\mathbf{x}',t_c)}{c^2r}\right]d^3x'$$

$$r = |\mathbf{x}-\mathbf{x}'| \qquad c = \frac{1}{\sqrt{\epsilon_0\mu_0}} \qquad t_c = t - \frac{r}{c}$$

Flaws in the Maxwell Lorentz theory:

1. *The Coulomb force propagation velocity is equal to 'c' according to the Maxwell Lorentz theory. This has been falsified by experiments.*
2. *Unexplained longitudinal electric far fields exist in Jefimenko's field solutions, see the expressions in red.*
3. *The Lorentz force does not satisfy Newton's third law of motion:* $\mathbf{f}_T(\boldsymbol{x}) \neq -\mathbf{f}_T(\boldsymbol{x'})$ in case of magneto statics



Review of Maxwell-Lorentz theory, the simplest FIX for the mentioned flaws

Can *divergent* electric fields be sourced/generated by dynamic *divergent* currents, similar to *rotational* electric fields that are sourced/generated by dynamic *rotational* currents according to Faraday's law? If there is no experimental evidence for this, we can apply Ockham's razor and introduce the following physical condition: $\nabla\cdot(\partial_t \mathbf{A}) = 0$

Field definitions:

$$\mathbf{E} = -\nabla\Phi - \frac{\partial \mathbf{A}}{\partial t} \qquad \text{and} \quad \nabla\cdot\frac{\partial \mathbf{A}}{\partial t} = 0$$

$$\mathbf{B} = \nabla\times\mathbf{A}$$

Field equations:

$$\nabla\cdot\mathbf{E} = -\nabla\cdot\nabla\Phi = \frac{\rho}{\epsilon_0} \qquad \text{Gauss law}$$

$$\nabla\cdot\mathbf{B} = 0$$

$$\nabla\times\mathbf{E} + \frac{\partial \mathbf{B}}{\partial t} = \mathbf{0} \qquad \text{Faraday law}$$

$$\nabla\times\mathbf{B} - \frac{1}{c^2}\frac{\partial \mathbf{E}}{\partial t} = \mu_0\mathbf{J} \qquad \text{Ampère law}$$

$$\nabla\times\nabla\times\mathbf{A_t} + \frac{1}{c^2}\frac{\partial^2\mathbf{A_t}}{\partial t^2} = \mu_0\mathbf{J_t}$$

$$0 = \nabla\cdot\mathbf{J} + \frac{\partial\rho}{\partial t} \qquad \textbf{Charge conservation}$$

$$\mathbf{f} = \rho\mathbf{E} + \mathbf{J}\times\mathbf{B} \qquad \textbf{Lorentz force density}$$

Jefimenko's general field solutions:

$$\mathbf{B}(\mathbf{x},t) = \frac{\mu_0}{4\pi}\int_{V'}\left[\frac{\mathbf{J_t}(\mathbf{x}',t_c)\times\mathbf{r}}{r^3} + \frac{\dot{\mathbf{J}}_\mathbf{t}(\mathbf{x}',t_c)\times\mathbf{r}}{cr^2}\right]d^3x'$$

$$\mathbf{E}(\mathbf{x},t) = \frac{1}{4\pi\epsilon_0}\int_{V'}\left[\frac{\rho(\mathbf{x}',t)\mathbf{r}}{r^3} - \frac{\dot{\mathbf{J}}_\mathbf{t}(\mathbf{x}',t_c)}{c^2 r}\right]d^3x'$$

$$r = |\mathbf{x}-\mathbf{x}'| \qquad c = \frac{1}{\sqrt{\epsilon_0\mu_0}} \qquad t_c = t - \frac{r}{c}$$

All the flaws are fixed by the extra condition, expect for Newton's third law not satisfied by the Lorentz force. The resulting theory does not have *gauge freedom*, so arbitrary gauge conditions are now *invalid*. In case an experimental proof for *divergent* electric fields exists, that are sourced by *divergent* dynamic currents (and also experimental proof for *longitudinal* Ampère forces and for *longitudinal* electrodynamic waves), then this fixed theory is too limited. There is a more general approach to fixing the flaws in Maxwell's electrodynamics, by adding scalar fields to the equations.

A generalized Electrodynamics theory that includes scalar fields

The following theory of electrodynamics is a much more robust fix for the mentioned flaws, without limiting the theory. Two extra *scalar* fields B_c and B_a are defined and included in the field equations. Another speed constant 'a' is introduced, such that a>>c. Speed 'a' is the super luminal propagation speed of the Coulomb force.

Generalized field definitions:

$$\mathbf{E} = -\nabla\Phi - \frac{\partial \mathbf{A}}{\partial t}$$

$$\mathbf{B} = \nabla\times\mathbf{A}$$

$$B_\Phi = -\frac{\partial \Phi}{\partial t} \qquad B_A = -\nabla\cdot\mathbf{A}$$

$$B_c = \frac{1}{c^2}B_\Phi + B_A \qquad B_a = \frac{1}{a^2}B_\Phi + B_A$$

Generalized field equations:

$$\nabla\cdot\mathbf{E} - \frac{\partial B_a}{\partial t} = \frac{\rho}{\epsilon_0} = \frac{1}{a^2}\frac{\partial^2\Phi}{\partial t^2} - \nabla^2\Phi$$

$$\nabla\cdot\mathbf{B} = 0$$

$$\nabla\times\mathbf{E} + \frac{\partial \mathbf{B}}{\partial t} = \mathbf{0}$$

$$\nabla\times\mathbf{B} + \nabla B_c - \frac{1}{c^2}\frac{\partial \mathbf{E}}{\partial t} = \mu_0\mathbf{J} = \frac{1}{c^2}\frac{\partial^2\mathbf{A}}{\partial t^2} - \nabla^2\mathbf{A}$$

$$0 = \nabla\cdot\mathbf{J} + \frac{\partial\rho}{\partial t} \qquad \textbf{Charge conservation}$$

$$\mathbf{f} = \rho\mathbf{E} + \mathbf{J}\times\mathbf{B} + B_a\mathbf{J} \qquad \textbf{Whittaker force density}$$

Generalized general field solutions:

$$B_\Phi(\mathbf{x},t) = \frac{1}{4\pi\epsilon_0}\int_{V'}\frac{-\dot\rho(\mathbf{x}',t_a)}{r}d^3x'$$

$$B_A(\mathbf{x},t) = \frac{\mu_0}{4\pi}\int_{V'}\left[\frac{\mathbf{J_l}(\mathbf{x}',t_c)\cdot\mathbf{r}}{r^3} + \frac{\dot{\mathbf{J}}_\mathbf{l}(\mathbf{x}',t_c)\cdot\mathbf{r}}{cr^2}\right]d^3x'$$

$$\mathbf{B}(\mathbf{x},t) = \frac{\mu_0}{4\pi}\int_{V'}\left[\frac{\mathbf{J_t}(\mathbf{x}',t_c)\times\mathbf{r}}{r^3} + \frac{\dot{\mathbf{J}}_\mathbf{t}(\mathbf{x}',t_c)\times\mathbf{r}}{cr^2}\right]d^3x'$$

$$\mathbf{E}(\mathbf{x},t) = \frac{1}{4\pi\epsilon_0}\int_{V'}\left[\frac{\rho(\mathbf{x}',t_a)\mathbf{r}}{r^3} + \frac{\dot\rho(\mathbf{x}',t_a)\mathbf{r}}{ar^2} - \frac{\dot{\mathbf{J}}_\mathbf{l}(\mathbf{x}',t_c)}{c^2r} - \frac{\dot{\mathbf{J}}_\mathbf{t}(\mathbf{x}',t_c)}{c^2r}\right]d^3x'$$

$$r = |\mathbf{x}-\mathbf{x}'| \qquad c = \frac{1}{\sqrt{\epsilon_0\mu_0}} \qquad t_c = t - \frac{r}{c} \qquad t_a = t - \frac{r}{a} \qquad a \gg c$$

The two unexplained longitudinal electric 'far field' wave components are now matches by two scalar 'far field' wave components. One of the longitudinal waves (see the **blue** expressions) has the same velocity as the *super luminal* Coulomb force propagation (v=a >>c), and the other longitudinal wave (see the **green** expressions) has the same velocity as the TEM wave (v=c). This theory does not have gauge freedom, and it also solves the violation of the Lorentz force of Newton's third law of motion. Surprisingly, this generalized theory of electrodynamics also solves the notorious 4/3 problem in electromagnetic mass theory, such that one can derive the famous equation $E = mc^2$ without relativity theory. This theory breaks U(1) symmetry, but this does not provide mass to the photon, since it does not satisfy Einstein causality. It is not a renormalizable theory. If we set a=c then this generalized electrodynamics theory reduces to the standard Maxwell-Lorentz electrodynamics.

A generalized Electrodynamics theory that includes scalar fields (continued)

Power and Force theorems, include scalar field terms:

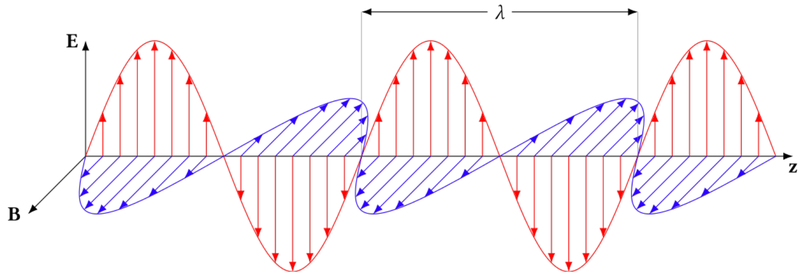
$$-\mathbf{E}\cdot\mathbf{J} - c^2 B_c \rho = \frac{\epsilon_0}{2}\frac{\partial(\mathbf{E}\cdot\mathbf{E})}{\partial t} + \frac{1}{2\mu_0}\frac{\partial(\mathbf{B}\cdot\mathbf{B})}{\partial t} + \frac{1}{\mu_0}B_c\frac{\partial(B_a)}{\partial t} - \frac{1}{\mu_0}\nabla\cdot(\mathbf{E}\times\mathbf{B} + B_c\,\mathbf{E})$$

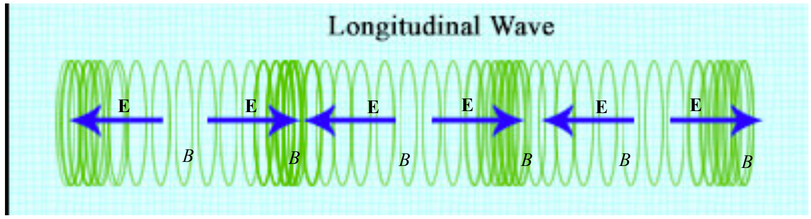
$$\rho\mathbf{E} + \mathbf{J}\times\mathbf{B} + B_a\mathbf{J} = \epsilon_0\left(\mathbf{E}\nabla\cdot\mathbf{E} + (\nabla\times\mathbf{E})\times\mathbf{E}\right) + \frac{1}{\mu_0}\left(\nabla B_c + \nabla\times\mathbf{B}\right)\times\mathbf{B} + \frac{1}{\mu_0}\left(\nabla B_c + \nabla\times\mathbf{B}\right)B_a - \epsilon_0\frac{\partial\left(B_a\mathbf{E} + \mathbf{E}\times\mathbf{B}\right)}{\partial t}$$

Three types of electrodynamic waves :

$\mathbf{E} = -\frac{\partial\mathbf{A}}{\partial t}$	$\mathbf{B} = \nabla\times\mathbf{A}$	Transverse electromagnetic wave, with velocity v <= c
$\mathbf{E} = -\frac{\partial\mathbf{A}}{\partial t}$	$B_A = -\nabla\cdot\mathbf{A}$	Longitudinal electromagnetic wave, with velocity v <= c
$\mathbf{E} = -\nabla\Phi$	$B_\Phi = -\frac{\partial\Phi}{\partial t}$	Scalar field wave, with velocity v <= a, a>>c

Transverse wave





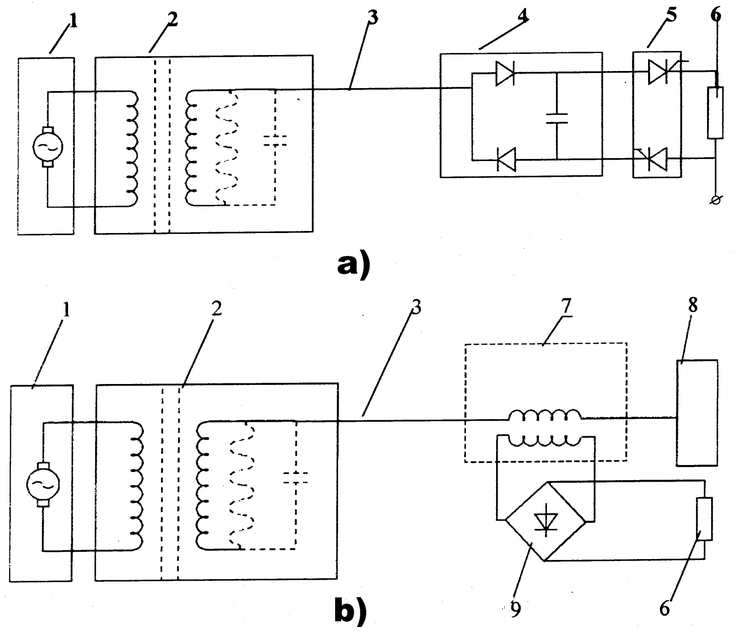
The scalar field wave has superluminal velocity, therefore most of its energy is in the scalar field component. In order to verify this Generalized Electrodynamics theory, it is necessary to do experiments that prove the existence of longitudinal electromagnetic waves, of scalar field waves, etc …

A generalized Electrodynamics theory that includes scalar fields (continued)

Experimental proof for Longitudinal Electromagnetic waves

SINGLE-WIRE ELECTRIC POWER SYSTEM FOR RENEWABLE-BASED ELECTRIC GRID

Dmitry S. Strebkov, Stanislav V. Avramenko, Aleksei I. Nekrasov
The All-Russian Research Institute for Electrification of Agriculture.

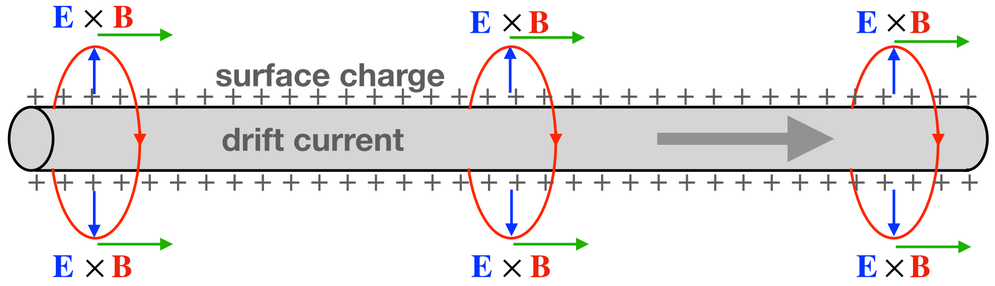


1. High frequency converter
2. Step-up high frequency Tesla transformer
3. Single-wire line 1-300 kHz
4. Diode-capacitor block
5. Thyristor electronic key
6. Electronic load
7. Step-down Tesla transformer
8. Electric capacitance
9. Rectifier

Results:

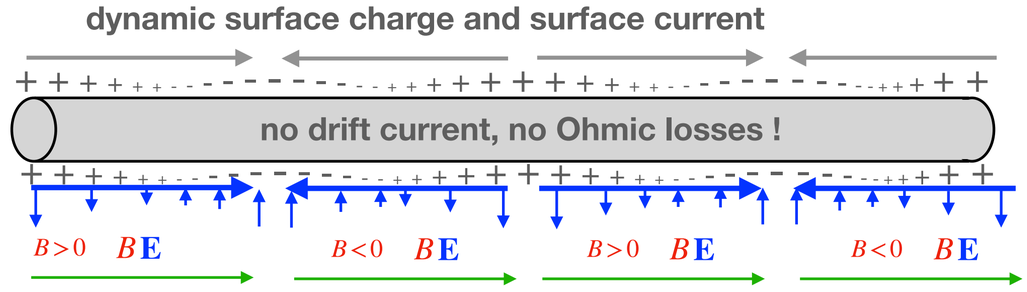
1 KWatt power transmission over longer distances in resonance mode. The single wire power transmission is lossless ("quasi superconductive"). The wire material does not matter (copper, aluminum, steel, carbon, etc). The wire diameter does not matter. There is no 'Earth return' in this system, which excludes a TEM wave Poynting flow.

Power flow in a standard 50-60Hz AC or DC system



$$\mathbf{E} = -\nabla\Phi$$
$$\mathbf{B} = \nabla\times\mathbf{A}$$

Power flow in a high frequency single-wire electric power transport system



$$\mathbf{E} = -\nabla\Phi - \frac{\partial \mathbf{A}_1}{\partial t}$$
$$B_A = -\nabla\cdot\mathbf{A}$$

Only scalar field B_A explains the energy flow!

A generalized Electrodynamics theory that includes scalar fields (continued)

The physics of ENERGY TRANSFER by means of superluminal electrodynamic scalar waves

1. A *superluminal electrodynamic scalar wave* carries *energy*, but the *momentum* of this wave is negligible, since the velocity of scalar waves (v=a) is much higher than 'c': a>>c.

2. Superluminal scalar wave *energy transfer* between particles mainly changes the *potential energy* of particles. Scalar wave energy transfer changes the *kinetic energy* of particles very little, in comparison with photon exchange with comparable energy.

3. Since 'rest energy' of a particle is a form of electric potential energy according to electrodynamic mass theory, also the 'rest energy' (or mass energy) of a particle can be changed by means of scalar wave energy transfer.

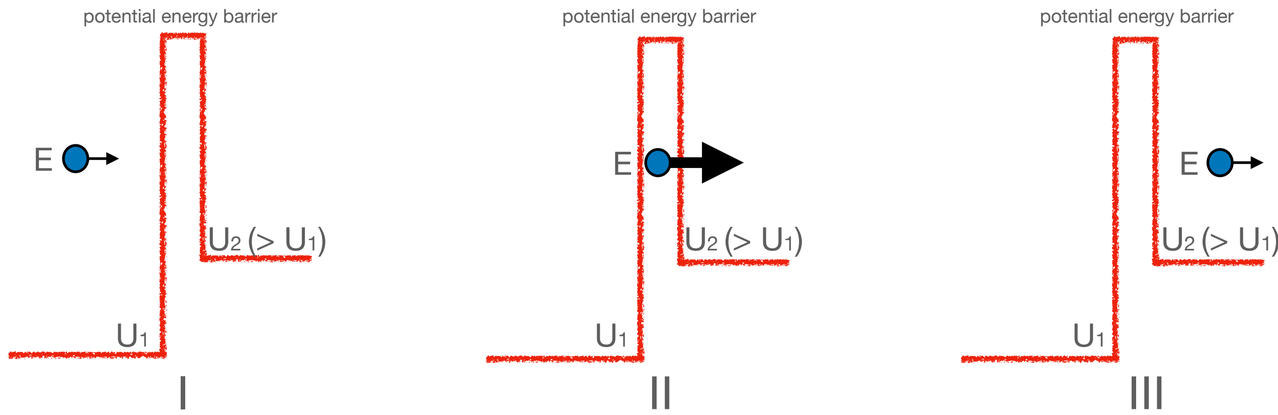
4. In order to receive or send scalar wave energy, a *particle* must be in *superluminal motion*. This happens during *quantum tunneling* through an *asymmetric* potential barrier, see the pictures on this slide.

5. A radiation background of superluminal scalar waves is possibly the origin of *Zero Point Energy (ZPE)* and the non-zero energy ground state of all particles.

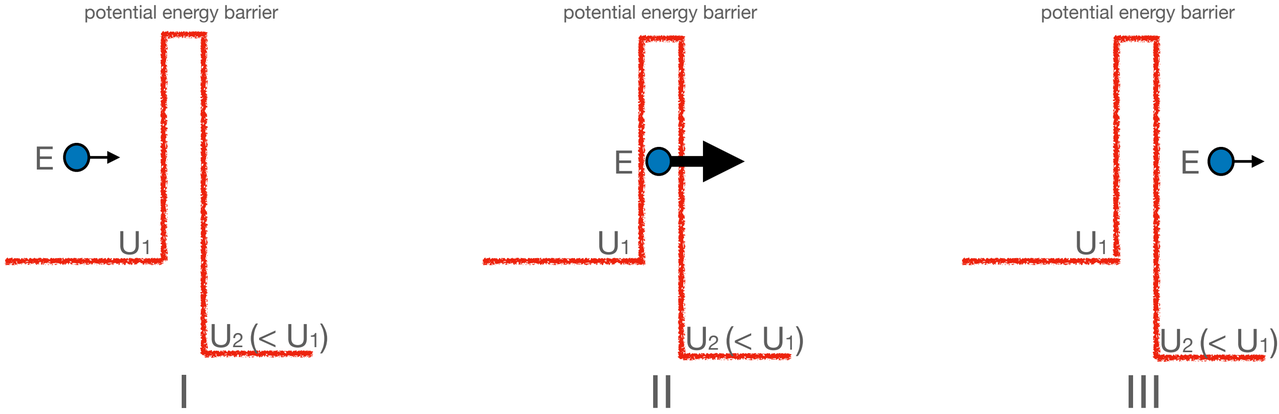
6. *Pilot Wave Theory,* by Dr. Louis de Broglie*,* describes quantum behavior as a superluminal Pilot Wave interaction with a subluminal Particle Soliton Wave. It is a natural suggestion that Pilot Waves are in fact superluminal electrodynamic scalar waves.

7. Dr. Antony Valentini describes quantum information transfer with superluminal velocity, in case Pilot Waves are in *non equilibrium* interaction with particle-waves, which does not satisfy Born's rule of QM. In my opinion, an example of non-equilibrium quantum statistical interaction is 'quantum tunneling through an asymmetric potential barrier'.

System *receives* scalar wave energy during tunneling



System *sends* scalar wave energy during tunneling

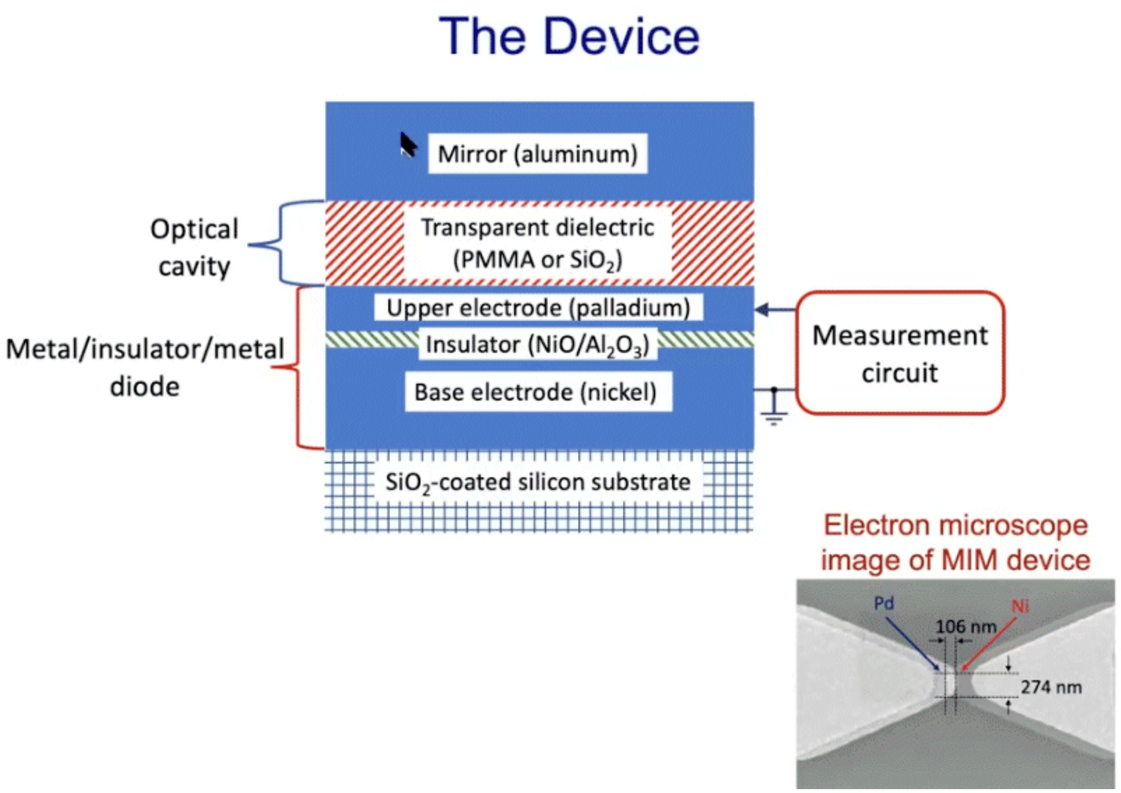


A generalized Electrodynamics theory that includes scalar fields (continued)

Examples of ENERGY HARVESTING of superluminal electrodynamic scalar wave energy

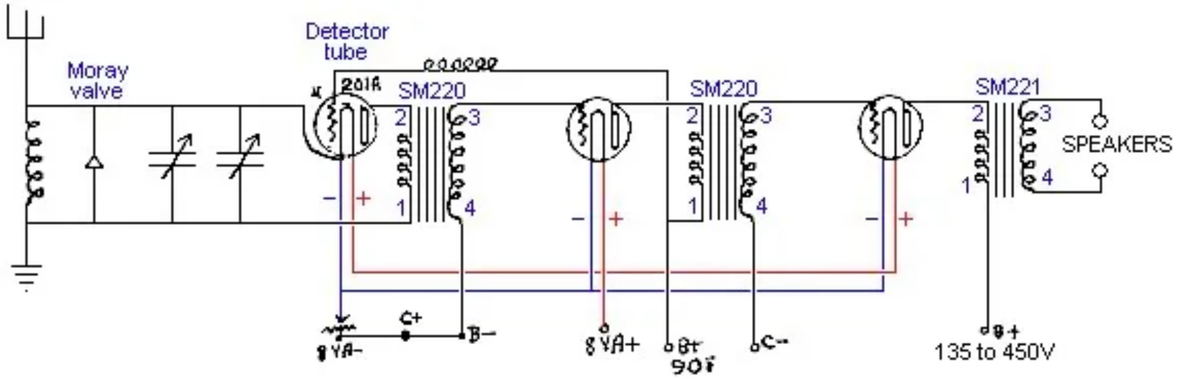
Dr. Garret Moddel's *ZPE harvesting MIM device (Micro Watts non stop)*

Based on Quantum Tunneling through an asymmetric 'Insulator potential barrier'.



Dr. Henry Moray's *ZPE Harvesting Vacuum Tube device (Kilo Watts non stop)*

Based on Fowler Nordheim Quantum Tunneling and 'cold cathode' Field Emission of electrons



A generalized Electrodynamics theory that includes scalar fields (continued)

Several examples of physical effects that could involve superluminal electrodynamic scalar waves

Synthesis of neutrons by fusing electrons with protons

According to electromagnetic mass theory, mass is a form of electric potential energy, which can be altered by scalar wave energy transfer. Dr. R.M. Santilli wrote a paper on the synthesis of neutrons by means of electron proton fusion: '*Confirmation of Don Borghi's experiment on the synthesis of neutrons from protons and electrons*'. This requires a considerable mass increase of the electron initially, since the neutron has more mass than the proton and electron masses summed. The absorption of a high energy gamma photon (which has considerable momentum) by an electron gives the electron a very high 'relativistic' velocity, such that the probability of electron capture by a proton is zero. An electron mass increase by means of *absorption of momentum free scalar wave energy* results into a low momentum heavy electron that can be captured by a proton.

LENR

The absorption of momentum free superluminal scalar radiation is a 'missing link' in the Widom Larsen theory of LENR: '*Ultra low momentum neutron catalyzed nuclear reactions on metallic hydride surfaces.*' The momentum of a synthesized neutron must be very low in order to fuse that neutron with an atom nucleus, and this rules out the absorption of a gamma photon.

Dr. T.H. Moray performed many LENR experiments by irradiation raw ores that contained metals which transmuted in other elements. The radiation was emitted by his specially designed vacuum tubes, and was most likely massless superluminal scalar radiation that has very little momentum.

Likewise, the transmutation experiments by Kenneth Shoulders involve the electron emission from a sharp cathode tip (which is a quantum tunneling effect), which can induce superluminal scalar wave energy. The scalar radiation may ionize air gas molecules by means of tunneling ionization (observed as "EV" traces), and which causes the transmutation of elements in a metal foil that receives this radiation. Shoulders and Sarfatti estimated the velocity of the observed "EV traces' by using a high speed camera, and they concluded the EV trace had a *superluminal* velocity.

Gravity impulse experiment

Dr. E. Podkletnov performed an experiment that confirmed the possibility of a superluminal wave signal, by means of a high voltage electronic discharge from a *superconductive* electrode surface. The superluminal wave front of the impulse beam, that was emitted during abrupt electronic discharges, had a gravitational 'push' effect on test samples of different materials. Electronic emissions from an electrode by means of a strong electric field automatically involves Fowler Nordheim tunneling, which means Podkletnov's device could have emitted superluminal electrodynamic scalar waves that have frequencies that cause a gravity-like push effect on all solid material in the path of the beam, even at great distances. One might call it a macroscopic pilot wave effect: a very strong coherent macroscopic pilot wave 'guides' a macroscopic object.

Conclusions

There is experimental evidence that confirms qualitatively the existence of electrodynamic scalar fields, electrodynamic scalar waves, and longitudinal electrodynamic waves. The experiments are low budget and reproducible by independent researchers. The practical value of new technology, optimized for electrodynamic scalar field effects, could be very high.

It is desirable to return to fundamental and reproducible (low budget) experimentation, that can be meaningful and of practical importance for society. After all, the essence of the scientific method of research is the reproducibility of experiments and observations, and secondly, practicing Bacon's method of inductive reasoning in order to discover the essential laws of nature.

Thank you very much for your attention!