An Armchair Look at ECE Electromagnetic Theory

With An Explanation of LENR and other Pathological Science

Douglas W. Lindstrom
AIAS
July 10, 2015

www.AIAS.US

What Is AIAS?

Academic institute who's aim is to further the Einstein Cartan Evans unified theory of physics and promote the development of new technologies and science that result from its' study, such as

- free energy devices
- electrogravitation

Web-based

- run on volunteer basis
- 2 - 3 million website visitors every year
- Site hosted by Annexa., of New York State

www.AIAS.US

What Is AIAS?

Founded Myron W. Evans (1998) in Wales-civil list pension (2005), armorial bearings (2008)

Presidents

- Myron Wyn Evans*, Gent., Civil List Pensioner, D. Sc., Ph. D., B. Sc. (Wales).
- Gareth John Evans, Ph. D., B. Sc. (Wales)

Directors

- Horst Eckardt*, Ph. D., B. Sc. (Clausthal), President of UPITEC
- Douglas W. Lindstrom*, Ph. D., M. Sc., B. Sc. (British Columbia)
- Robert Cheshire (Liverpool)
- Alex Hill (Mexico City), also a Director of UPITEC.

Pathological Science

Pathological science “false results ... by subjective effects, wishful thinking or threshold interactions”*

- **threshold interactions** -"a statistical phenomenon where unforeseen relationships between input variables may cause unanticipated results”*

*Irving Langmuir-Colloquium at The Knolls Research Laboratory, December 18, 1953

Pathological Science

Examples of pathological science include

- Mitogenetic rays
- Biological effects of magnetic fields
- Extrasensory Perception
- Flying Saucers and UFO's
- Water Dowsing
- Martian canals
- Darwin's evolution
- General Relativity
- Cold fusion
- Free energy devices

Pathological Science

When is a theory believable?

- Scientific method / testable / reproducible
- Based on rational thought
- Occam's razor
- Science establishment rejects significant advancement at first then claims it unconditionally.
  - Eg. Tesla, Edison...

Topics Covered

Brief history of physics and a look forward

Explanation of ECE theory

Applications of ECE theory

- LENR
  - ECAT
- Homopolar generator
- Osamu Ide experiment
- ET3M - Mexico

Classical Physics - Gravitation

Kepler explained the motion of planets in terms of elliptical orbits

Johannes Kepler
1571-1630

Galileo improved the telescope and charted motions of planets and discovered four moons of Jupiter

Galileo Galilei
1564-1642

Newton postulated inverse square law of gravitational force between two bodies

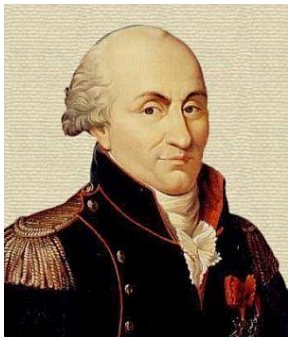
Isaac Newton
1643-1727

Source: www.wikipedia.org

Classical Physics- Electromagnetism

Coulomb's Law-attraction of opposite charges

$$F = k\frac{|q_1 q_2|}{r^2}$$



Charles Augustin de Coulomb
1736-1806

Faraday's Law-magnetic induction

$$\varepsilon = -\frac{\partial \Phi}{\partial t}$$

Michael Faraday
1791-1867

Ampere's Law

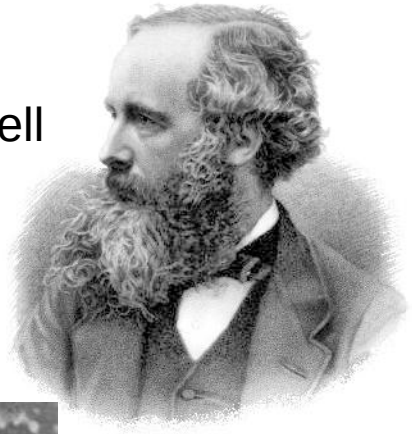
$$\mu_0 I = \oint_c B \cdot dl$$

Andre-Marie Ampere
1775-1836

Source: www.wikipedia.org

Classical Physics- Electromagnetism

James Clerk Maxwell
1831-1879



Unification of electricity and magnetism

- Quaternion based (Maxwell)
  - 12 equation and unknowns
- Reduced to vectors (Heaviside)
  - Two vector and two scalar equations
- Gauge freedom (Lorenz)
  - Automatic in classical field theory

Oliver Heaviside
1850-1925

Ludvig Lorenz
1829-1891

Source: www.wikipedia.org. www.nndb.com

Classical Physics – Field Theory

By the end of the 1900's classical field theory explained

- solid mechanics/elasticity
- fluid flow
- heat Flow
- electromagnetism
- acoustics
- gravitation

Classical Physics - 1900

Maxwell claimed that the only things a physicist needed were paper and pencil and anything could be figured out.

Michelson said in 1894 that all the fundamental discoveries had been made and subsequent developments would be in the sixth decimal place.

Experimental science was obsolete; physicists were feeling pretty smug.

Albert Michelson
1852-1931

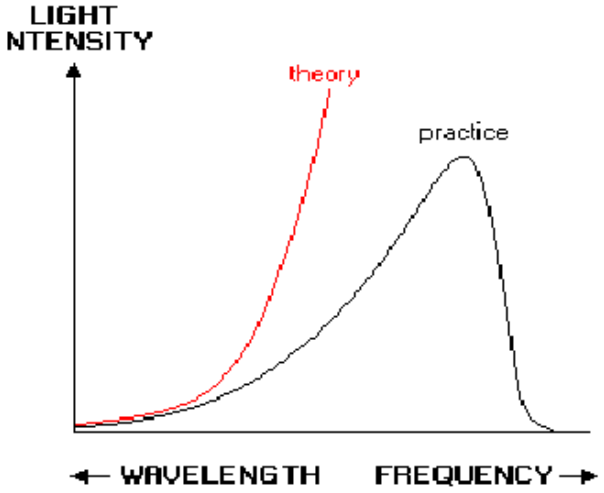
Source: www.wikipedia.org

Holes in the Armor

Fraunhofer - spectral lines, discrete spectrum for light (1817)

Joseph von Fraunfoffer
1787-1826

Ultraviolet catastrophe



Source: www.wikipedia.org

Holes in the Armour

Michelson-Morley experiment

- speed of light independent of source
- no ether (1887)

Edward W. Morley
1838-1923

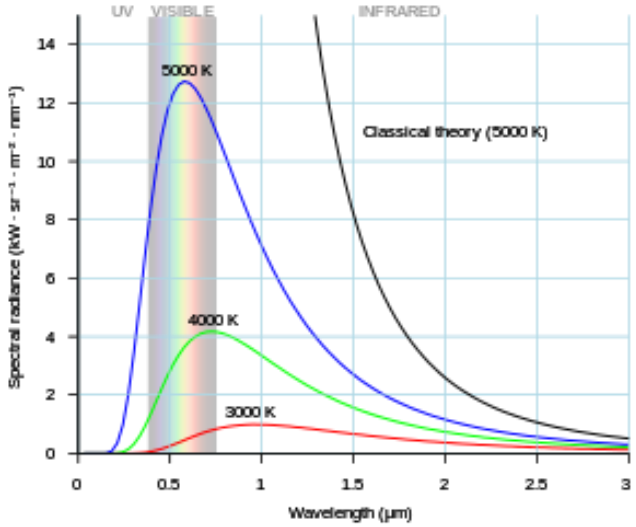
Photoelectric effect (experimental)

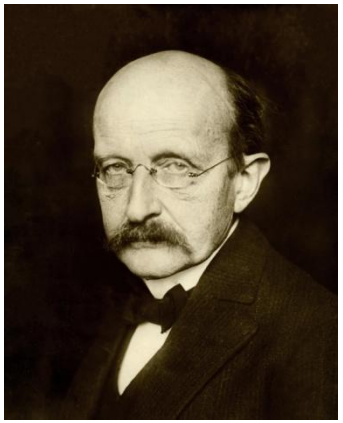
- energy of ejected electrons dependent on frequency not intensity of incident light (1902)

Source: www.wikipedia.org

Ushering in the “New Physics”-Quantum Theory

Planck proposed radiant energy is proportional to frequency and is quantized (1900)

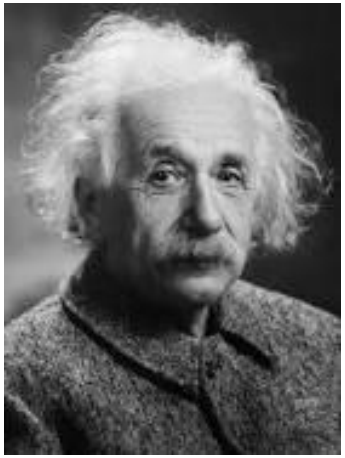




Max Planck
1858-1957

Einstein – photoelectric effect (1905)
(wave particle duality for photons)

$$E = h\nu$$



Albert Einstein
1879-1955

Source: www.wikipedia.org

Ushering in the “New Physics”-Quantum Theory

When change happens, it happens quickly:

1902 **Phillip Lenard** demonstrates that energy of electron emitted in photoelectric effect depends of frequency of photon.

1911 **Ernest Rutherford** infers the nucleus

1913 **Niels Bohr** constructs a quantum theory of atomic structure.

1919 **Ernest Rutherford** discovers the proton.

1924 **Louis de Broglie** proposes that matter has wave properties.

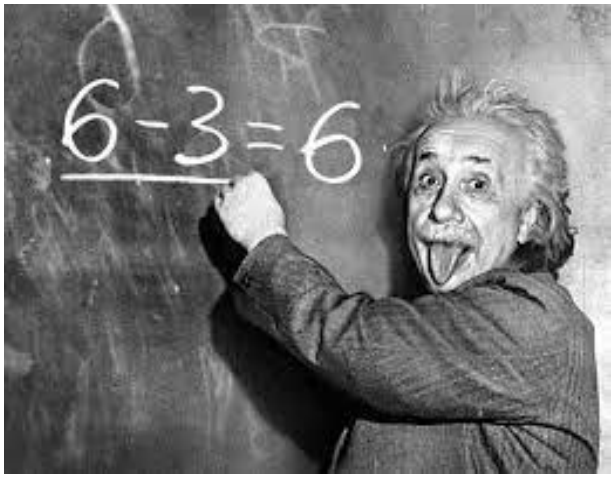
1925 **Erwin Schrodinger** develops wave mechanics.

Source: www.wikipedia.org

Ushering in the “New Physics”-Relativity

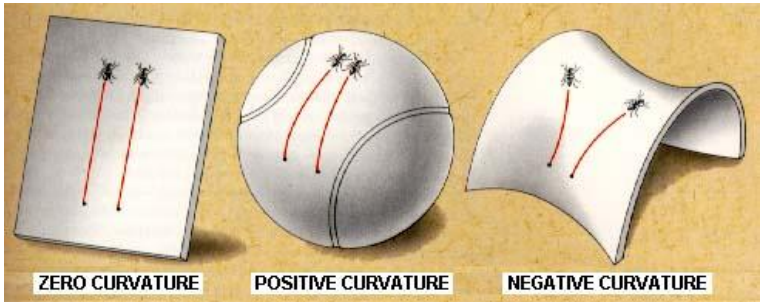
Einstein – Special Relativity (1905)

- Speed of light is constant irrespective of the speed of the observer
- Time dilation, distance distortion



Einstein- General Relativity (1915)

- Matter curves the structure of space-time. This curvature is felt as the force of gravity, and is not distinguishable from the inertial force an accelerating body feels.



Source: www.wikipedia.org, www.yuandong-tian.com

Ushering in the “New Physics”-Relativity

Eddington

- bending of starlight (1919) confirmed Einstein’s theory
- It’s hard to argue with good experimental data

Arthur Eddington
1882-1944

Eddington's photographs of the total solar eclipse of 1919

Source: www.wikipedia.org

Then Came the Standard Model

By the mid-twentieth century the groundwork for a new physics was in place

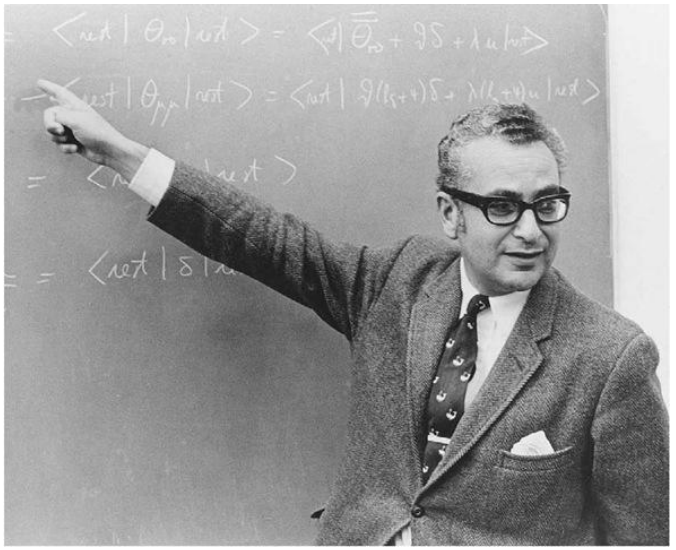
Murray Gell-Mann quark model (1963)

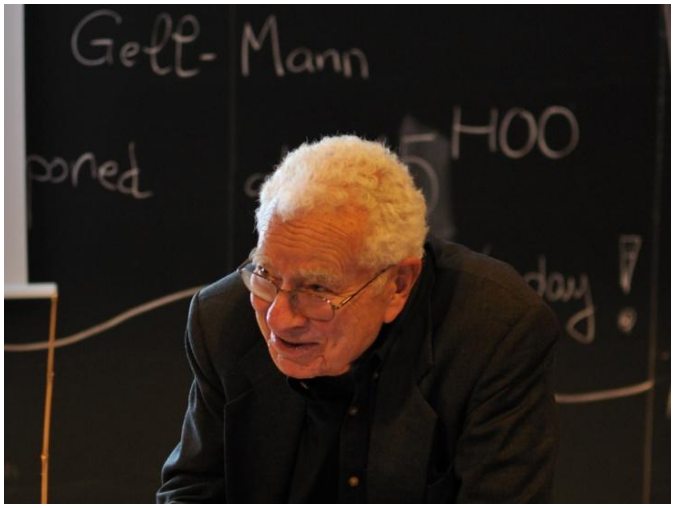
Weinberg-Glashow electroweak theory (1967)

Standard model proposed (1973)

- 61 elementary particles
  - Come in colours and flavours
  - Offshoots include quantum electrodynamics, quantum field theory.

Source: askeyphysics.org, commons.wikimedia.org





Murray Gell-Mann
1929-

The Standard Model

Quarks and Leptons-elementary particles

Force carriers are virtual particles

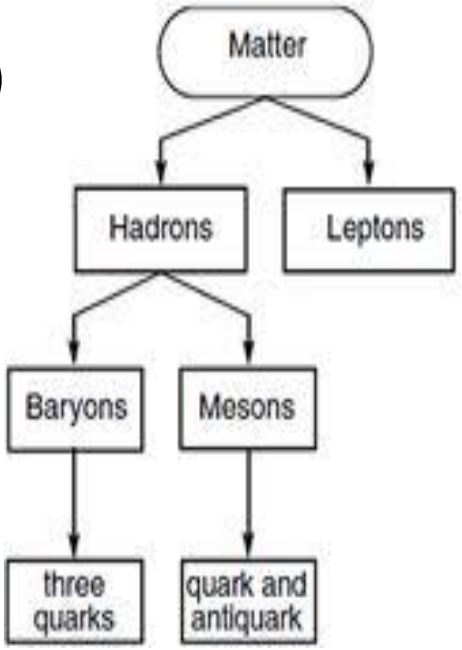
- gluon-strong force
- photon-electromagnetic force and weak force

Higgs particle (proposed1964)

- experimentally discovered (2012)
- explains mass, inertia
- Is it an experimental artifact?

Gravity still not included in standard model

Peter Higgs
1929-



Source: www.ph.ed.ac.uk, cargocollective.com

Holes in the Standard Model

By 1932 it was recognized that the motions of the galaxies didn't fit the relativistic or Newtonian model of gravity

Solution - Patch it up with dark matter and dark energy composed of an as yet undiscovered sub atomic particle. Current thinking is that this universe consists of

- 4.9% ordinary matter
- 26.8% dark matter
- 68.3% dark energy

Source: www.wikipedia.org

Holes in the Standard Model

Inconsistencies in electromagnetism:

Can not be unified with gravity

- Einstein tried for years, as have others, Hawkins, Penrose,,,

Can not explain homopolar generator adequately

- A rotating disk in a magnetic field generates a current in the disk

Can not completely explain inverse faraday effect

- Circularly polarized light induces a magnetic field in a rotating disk

Holes in the Standard Model

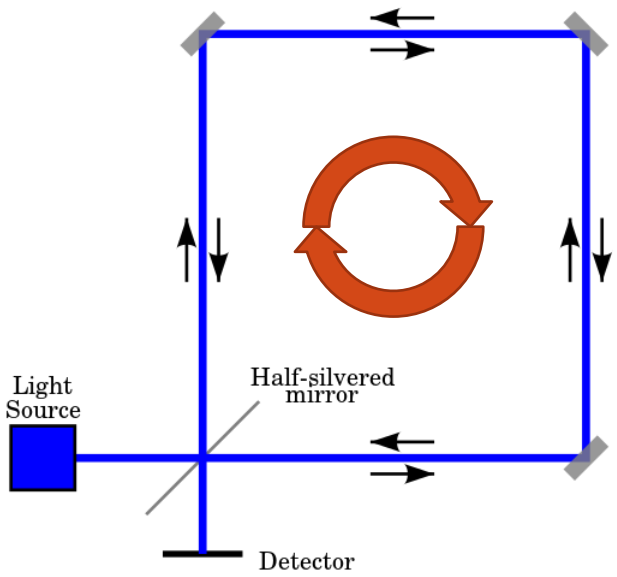
Aharonov-Bohm effect is poorly explained:

- a charged particle passing around a long solenoid experiences a phase shift as a result of the negligible magnetic field in the region through which the particle passes.
- Interaction with the vector potential when no magnetic field is present.

Holes in the Standard Model

Cannot explain the Sagnac effect:

- A beam of light is split and the two beams are made to follow a looping path but in opposite directions in a rotating apparatus.
- The relative phases of the two beams are shifted according to the angular velocity of the apparatus.



Source: www.physforum.com

Are We Due for a New Physics?

The standard model is about seventy-five years old. Is it becoming dated?

What is half life of a physics paradigm?

- Maxwell's electromagnetism survived for about seventy-five years before needing replacement.

What happened to "Occam" and "Francis Bacon"?

- dark matter and energy, multi-universes
- Has the scientific method been abandoned?
- CERN experiments can`t be duplicated (due to cost)

The Rise of the New Priesthood

String theory attempts to incorporate gravity in the standard model (Heisenberg 1940)

M theory or super string theory (1994)

- 11 dimensions sore of which are curled up
- experimental verification can’t be made
- so goes the scientific method, Occam's razor and reasonableness.
- natural laws understood only by “wiser” mediators.

This is not acceptable. Is their something else?

Topics Covered

Brief history of physics and a look forward

Explanation of ECE theory

Applications of ECE theory

- LENR
  - ECAT
- Homopolar generator
- Osamu Ide experiment
- ET3M - Mexico

Introducing ECE Theory

1925-1950 Einstein struggled unsuccessfully to combine electromagnetism and gravity using a torsion based geometry developed by Cartan.

Building on Einstein & Cartan, and earlier work on the B(3) field, Myron Evans introduced the ECE field theory in 2003.

- B(3) field consists of right and left circularly polarized plus a longitudinal components – basic mathematics but has been disputed by scientists who should know better.

Einstein's premise that "Physics = geometry" is the backbone of the theory coupled to Occam's razor.

Myron Evans
1950-

What is ECE Theory?

Physical theory that unifies electromagnetism, gravitation and general relativity, strong and weak forces, special relativity, and in so doing includes quantum theory.

Over 320 topical publications and more than 70 supportive publications in refereed journals, university libraries and government archives, and several websites.

2 - 3 million website visitors worldwide every year (www.aias.us)

What Does ECE Explain
(that the Standard Model doesn't do well at)

- LENR
- Inverse Faraday Effect
- Faraday disk (homopolar) generator
- Aharonov-Bohm Effect
- Polarization of light due to gravity
- Sagnac Effect
- Spiral galaxy geometry
- Singularity free cosmology (no dark matter)
- Accurate prediction of photon mass
- Incorporates quantum vacuum with interactions
- And the list goes on.....

ECE Contains the Standard Theories

- Mathematically equivalent to Maxwell in absence of matter
- Mathematically equivalent to Einstein in absence of charge
- Reduces to wave mechanics
- Retains field interactions (em-gravity, etc.) between all fundamental forces

Extending Maxwell's Equations

One way to explain the Aharonov-Bohm effect would be to allow potentials to have a defined (not floating) ground state

$$E = -\nabla\phi - \frac{\partial A}{\partial t} - F(\phi, A)$$

Depending on F, potentials now require a fixed ground (or zero) point. The simplest F might be the first term of a power series.

$$F(\phi, A) \approx \omega_0 A - \omega\phi$$

then

$$E = -\nabla\phi - \frac{\partial A}{\partial t} - \omega_0 A + \omega\phi$$

Extending Maxwell's Equations

For the magnetic field, assume

$$B = \nabla \times A - G(\phi, A)$$

If we plug these into the Faraday equation

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

we see

$$\frac{\partial}{\partial t} G(\phi, A) = \nabla \times (\omega_0 A - \omega \phi)$$

Extending Maxwell's Equations

We note that

$$G(\phi, A)$$

must be perpendicular to both ω and A making

$$G(\phi, A) = \omega \times A$$

the most likely choice, so that

$$B = \nabla \times A - \omega \times A$$

If one were very clever, the similarity between this and torsion of Cartan geometry would be recognized, which happened in 2003.

Properties of ECE Equations

The ECE equations are three well-defined equation systems (each with 8 equations and 8 unknowns); these can be reduced by antisymmetry conditions and additional constraints.

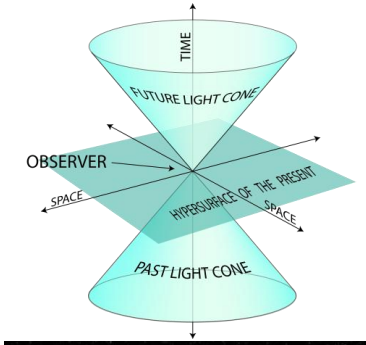
There is much more structure in ECE than in standard theory (Maxwell-Heaviside).

There is no gauge freedom in ECE theory.

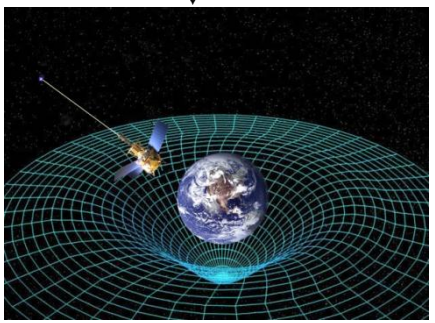
Resonance structures (self-enforcing oscillations) are possible in Coulomb and Ampère-Maxwell law

Understanding ECE Theory-Spacetime

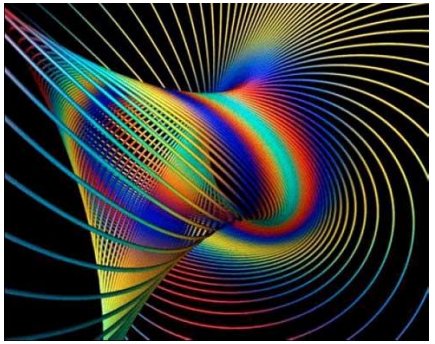
Special relativity introduces four dimensions: three dimensions of space (x, y, z) and one dimension of time.



General Relativity introduces a curved spacetime, objects follow curved geodesics in spacetime.



ECE is based on Cartan's twisted and bent spacetime and the axiom "physics is mathematics".

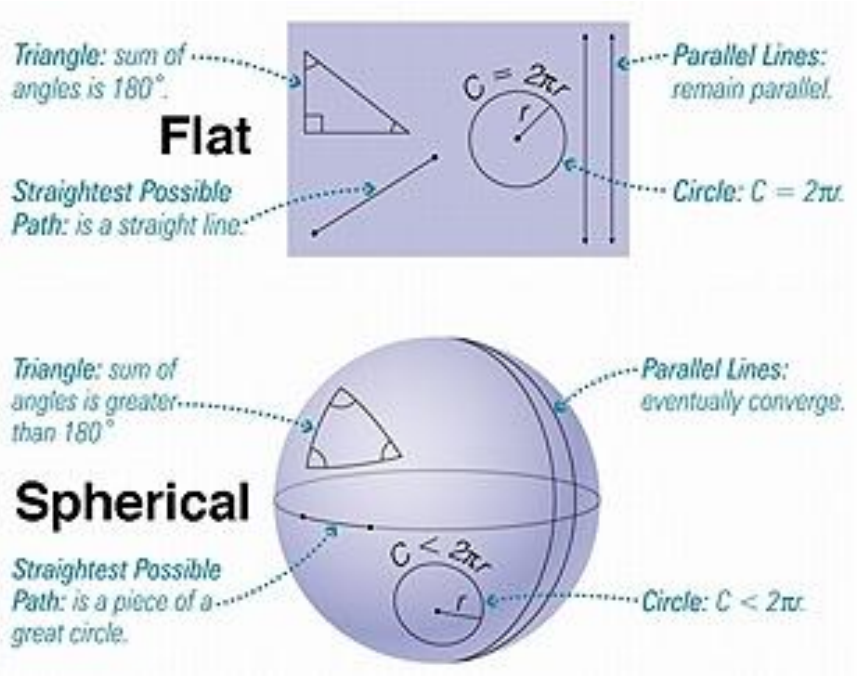


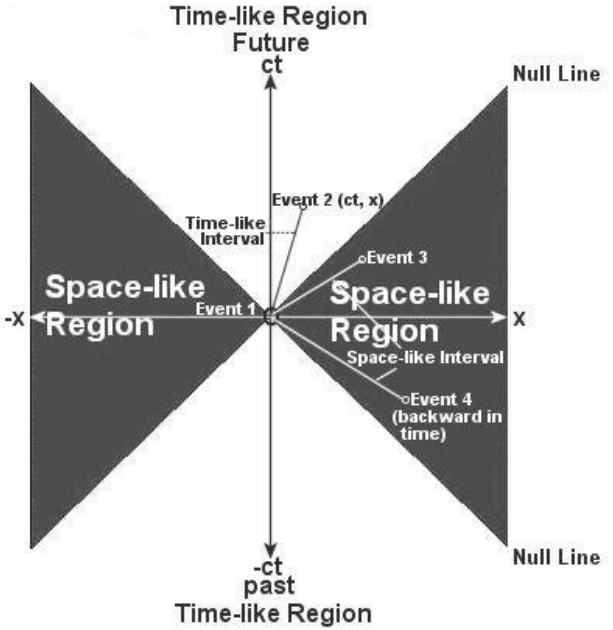
Source: www.space.com, www.lib-ebook.com

Understanding ECE Theory- Flat Space Geometry- Minkowski

Four dimensional $\{ct, x, y, z\}$

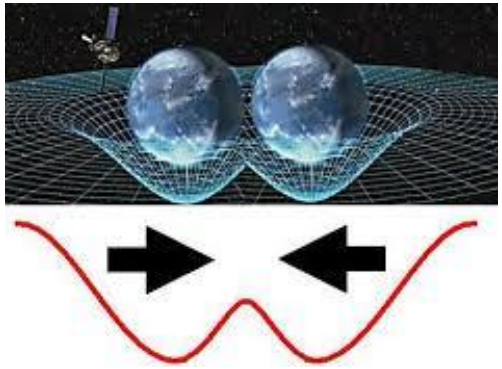
Flat spacetime

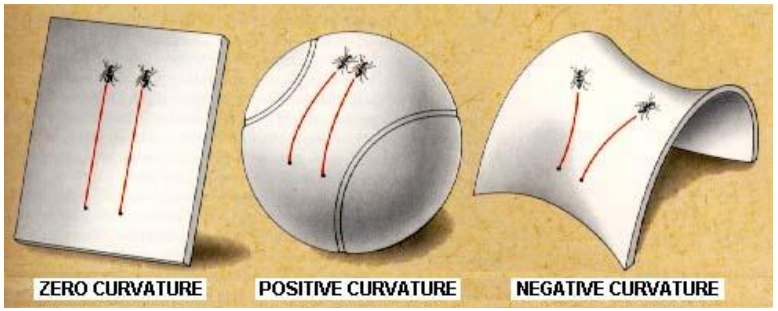




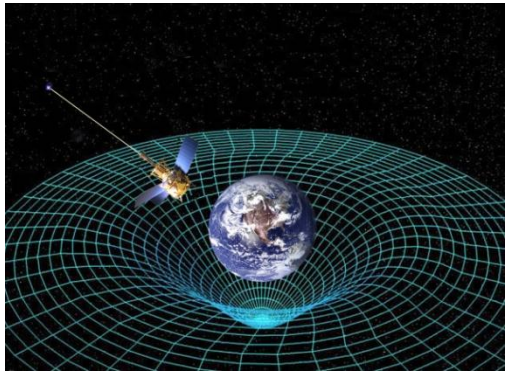
Source: www.daviddarling.info, ridiculousmind.com

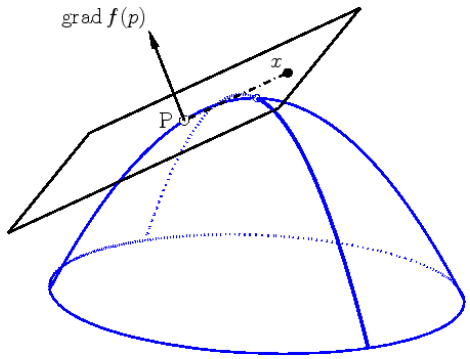
Understanding ECE Theory- Curved Spacetime - Riemann



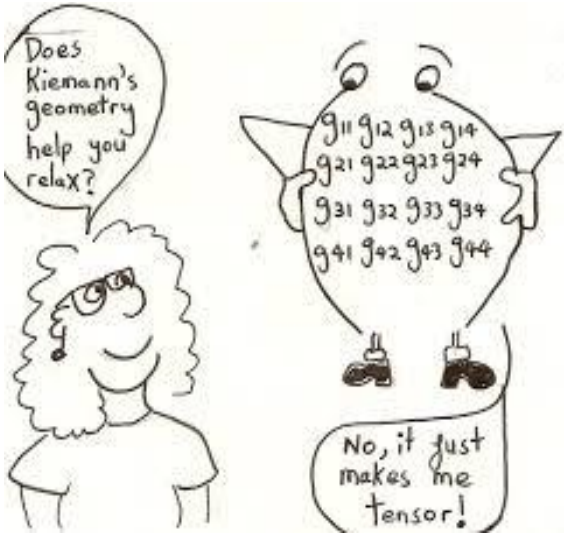


Curvature “creates” gravitational force.



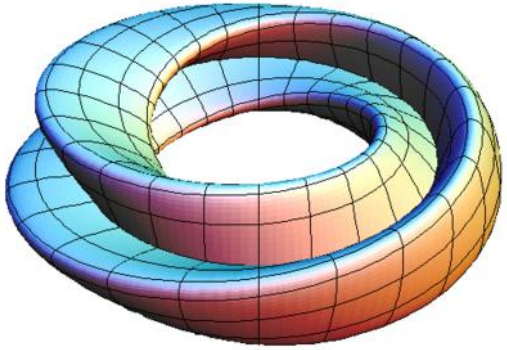


Tangent plane slides along geodesic

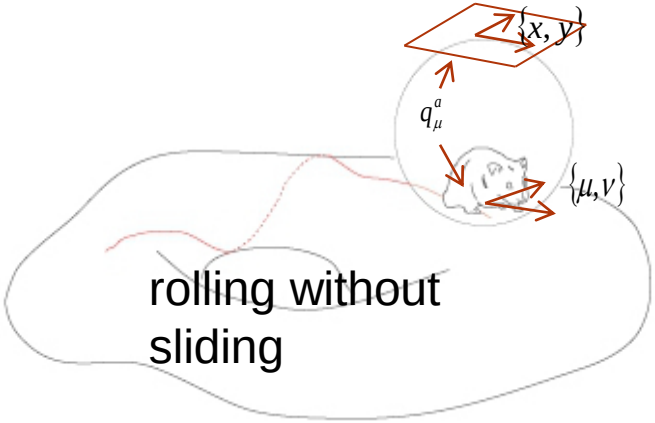


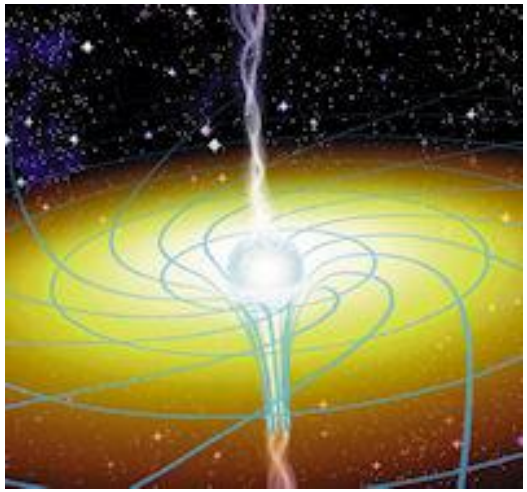
Source : www.space.com, nige.wordpress.com, www.yuandong-tian.com, www.mathematics-online.org, cartoon source unknown

Understanding ECE Theory- Curved Space with Torsion- Cartan



Klein geometry

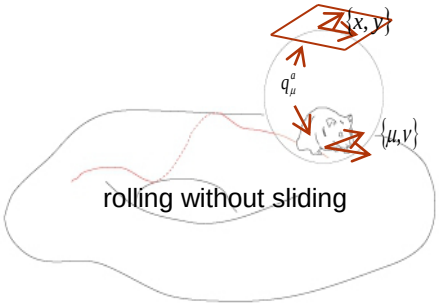




Source: mathforum.org, www.universetoday.com, dkwise.wordpress.com

How Does This Explain Physics?

Physics is governed by equations.



These equations must have the same form on a tangential plane or on a curved/twisted surface.

$$T^a = d \wedge q^a + \omega^a_b \wedge q^b$$

$$d \wedge T^a + \omega^a_b \wedge T^b = R^a_b \wedge q^b$$

$$R^a_b = d \wedge \omega^a_b + \omega^a_c \wedge \omega^c_b$$

Spin connection ω^a_b insures this. The tetrad q^a maps one surface to the other.

ECE Electromagnetism

Definition of Fields

$$T^a = d \wedge q^a + \omega_b^a \wedge q^b$$

$$B = \nabla \times A - \omega \times A$$

$$E = -\nabla\phi - \frac{\partial A}{\partial t} - \omega_0 A + \omega\phi$$

Magnetic charge and current
Non-trivial vacuum state

Field Equations

$$d \wedge T^a + \omega_b^a \wedge T^b = R_b^a \wedge q^b$$

$$R_b^a = d \wedge \omega_b^a + \omega_c^a \wedge \omega_b^c$$

$$\nabla \cdot B = \rho_m$$

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

$$\nabla \cdot D = \rho_e$$

$$\nabla \times H + \frac{\partial D}{\partial t} = J_e$$

Maxwell's Electromagnetism

Definition of Fields

$$T = d \wedge q$$

$$B = \nabla \times A$$

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

No magnetic charges or currents
No vacuum state

Field Equations

$$d \wedge T = 0$$

$$\nabla \cdot B = 0$$

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

$$\nabla \cdot D = \rho_e$$

$$\nabla \times H + \frac{\partial D}{\partial t} = J_e$$

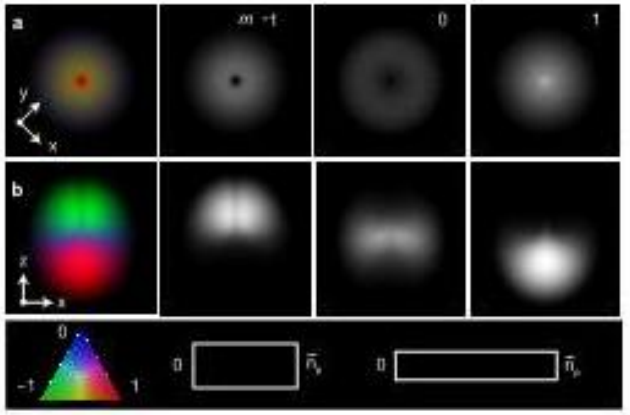
ECE and the Magnetic Monopole

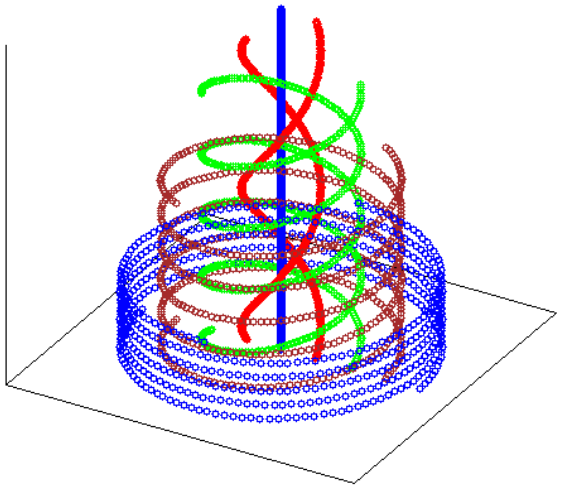
Magnetic monopoles

- Arxiv.org/pdf/1408.3133v1.pdf

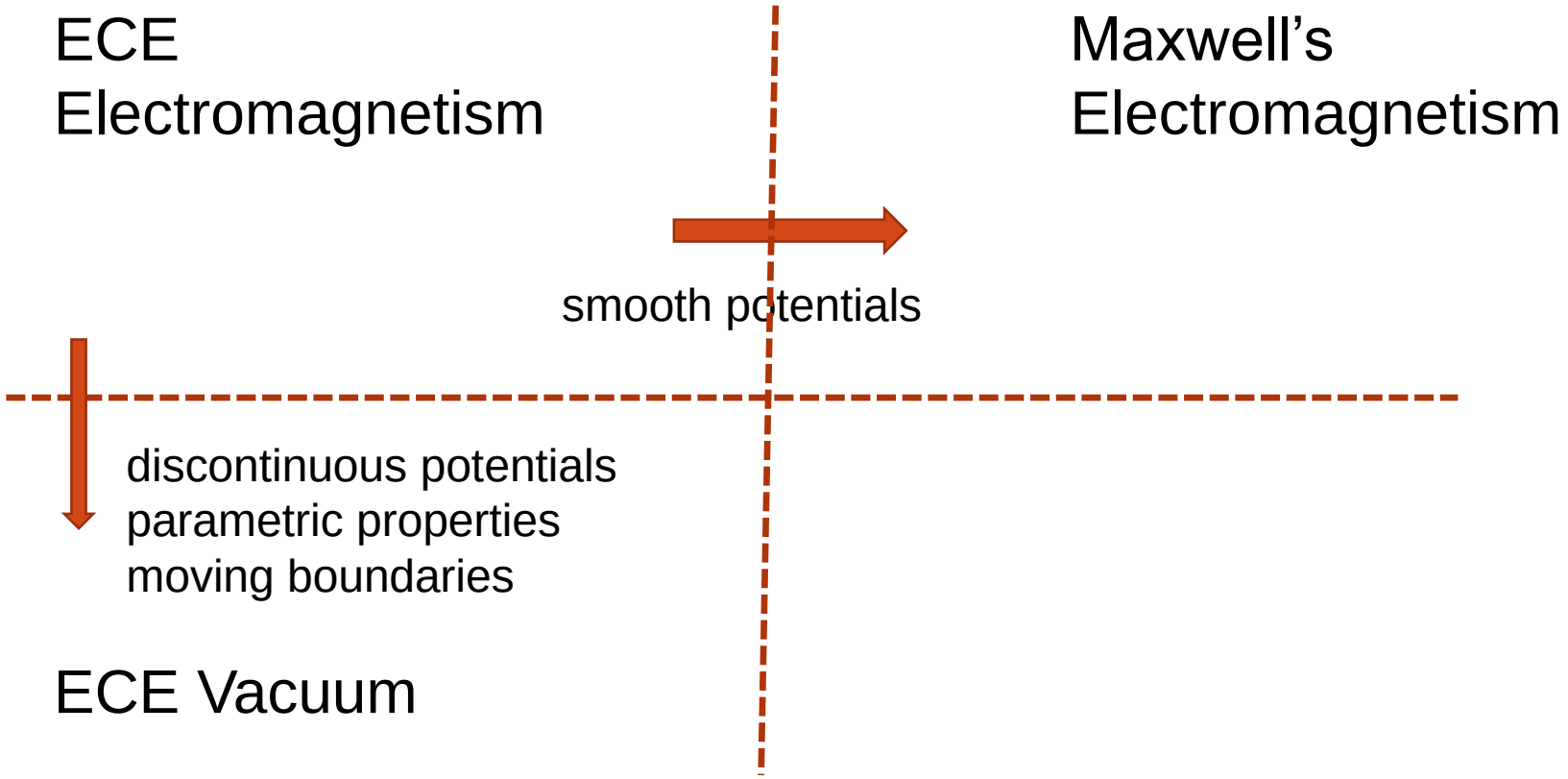
$$\nabla \cdot B = \rho_m$$

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





Three Regimes of ECE Electromagnetism



ECE Electromagnetic Vacuum State

ECE electromagnetic vacuum occurs when electric field and magnetic field, charges and currents are zero. This is not the quantum vacuum.

Supports wave propagation at light speed.

So far studied only for zero matter scenarios.

ECE fields float on the vacuum, and can interact with it only in a non-Maxwellian mode

There is no Maxwellian vacuum state

ECE Electromagnetic Vacuum State

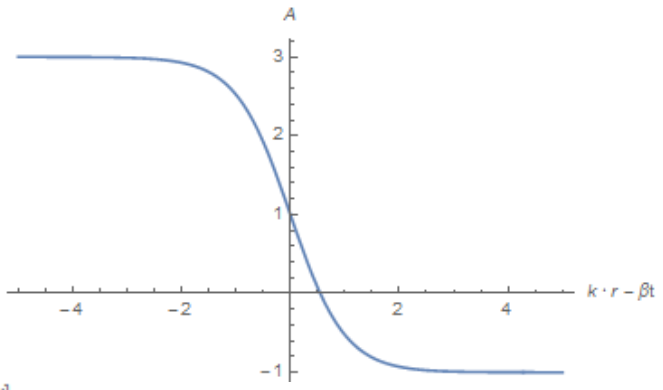
$$\underline{E} = 0$$

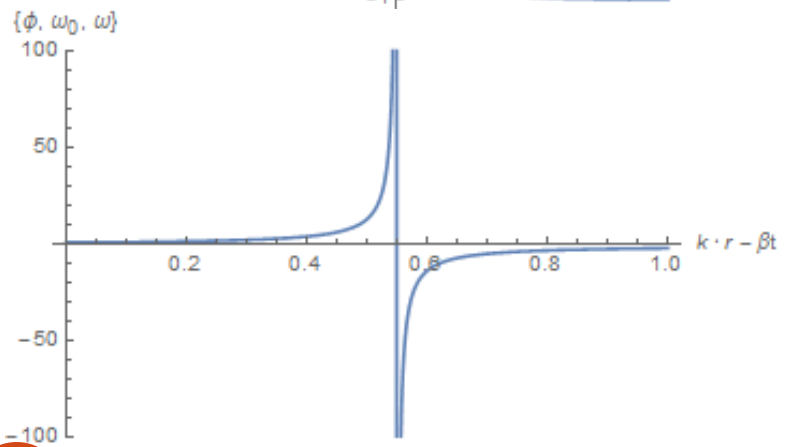
$$\underline{B} = 0$$

$$\underline{\nabla} \times \underline{A} = \underline{\omega} \times \underline{A}$$

$$\underline{\nabla}\phi + \frac{\partial \underline{A}}{\partial t} = -\omega_0 \underline{A} + \underline{\omega}\phi$$

Travelling Waves





$$\underline{A} \propto \underline{k}\left(a + bTanh\left(\underline{k}\cdot\underline{r} - \beta t\right)\right)$$

$$\phi \propto \frac{Cosh\left(\underline{k}\cdot\underline{r} - \beta t\right)}{aCosh\left(\underline{k}\cdot\underline{r} - \beta t\right) + bSinh\left(\underline{k}\cdot\underline{r} - \beta t\right)}$$

$$\underline{\omega} \propto -\underline{k}\frac{bSech^2\left(\underline{k}\cdot\underline{r} - \beta t\right)}{a + bTanh\left(\underline{k}\cdot\underline{r} - \beta t\right)}$$

$$\omega_0 \propto \beta\frac{bSech^2\left(\underline{k}\cdot\underline{r} - \beta t\right)}{a + bTanh\left(\underline{k}\cdot\underline{r} - \beta t\right)}$$

Spin Connection Resonance

Euler resonance in basic equations

$$m\ddot{r} + 2\gamma\dot{r} + kr = f(\beta t)$$

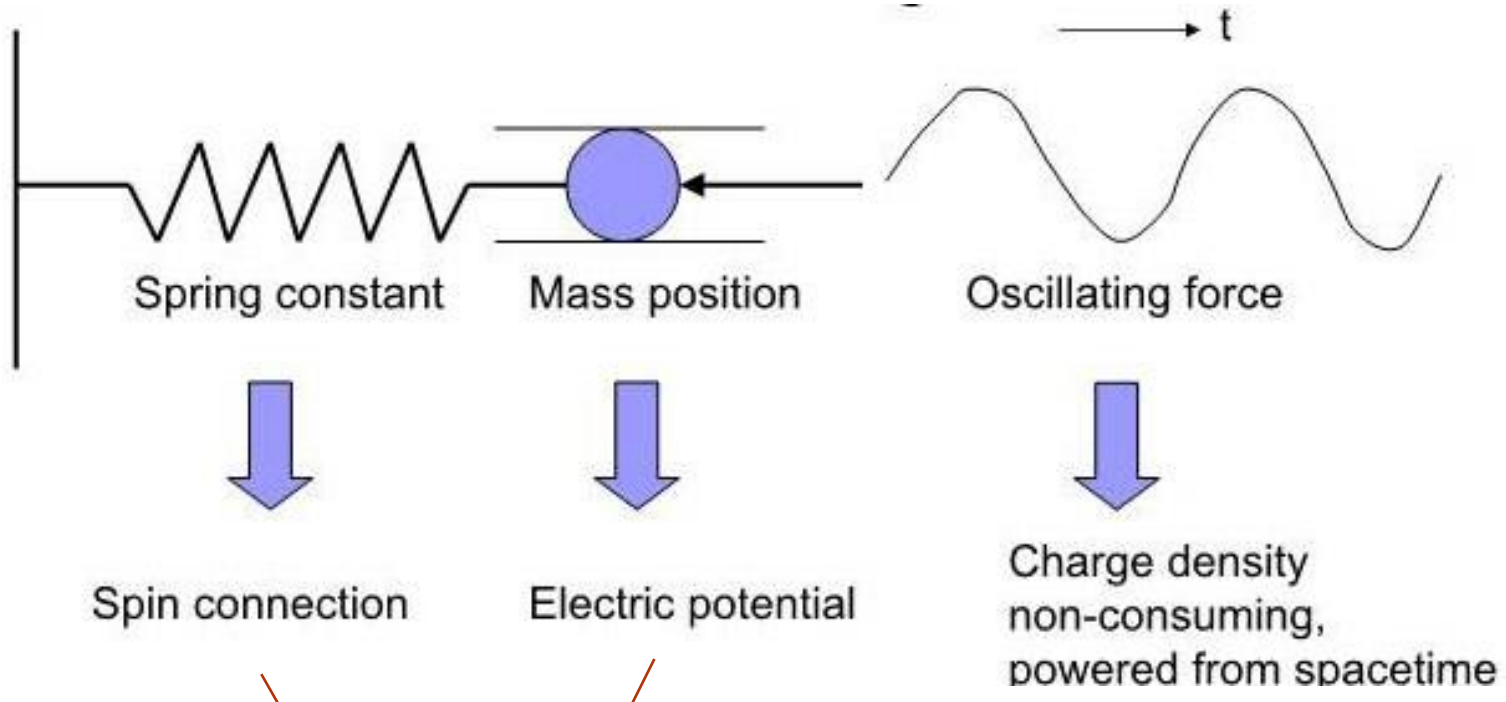
(1) Resonance within the spin structure of spacetime

$$\frac{\partial^2 A}{\partial t^2} + c\omega_0 \frac{\partial A}{\partial t} + cA\frac{\partial \omega_0}{\partial t} = -c^2 \nabla \times B$$

(2) ECE vacuum field resonance

$$\nabla^2 \phi + \omega^2 \phi = kA^{(vac)} \cdot \left(\nabla \omega_0 + \frac{\partial \omega}{\partial t} \right)$$

Source of Vacuum Energy



$$\omega^2\phi + \nabla^2\phi = kA^{(vac)} \cdot \left(\nabla\omega_0 + \frac{\partial\omega}{\partial t} \right)$$

Topics Covered

Brief history of physics and a look forward

Explanation of ECE theory

Applications of ECE theory

- LENR-ECAT
- Homopolar generator
- Osamu Ide experiment
- ET3M - Mexico

What is LENR?

Transmutation of one element to another using low energy impacting particles

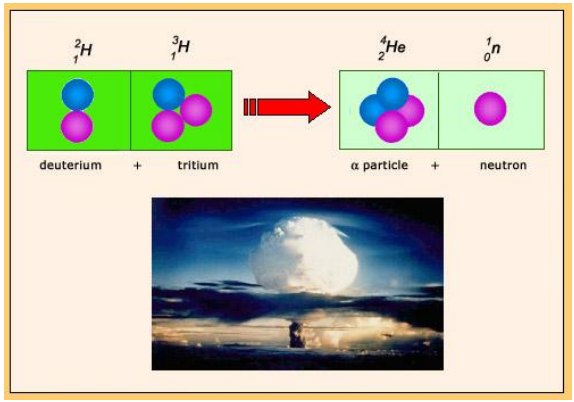
- possible release of other particles plus excess energy
- input energies significantly lower than existing technology

Transmutation of radioactive waste into non-threatening materials

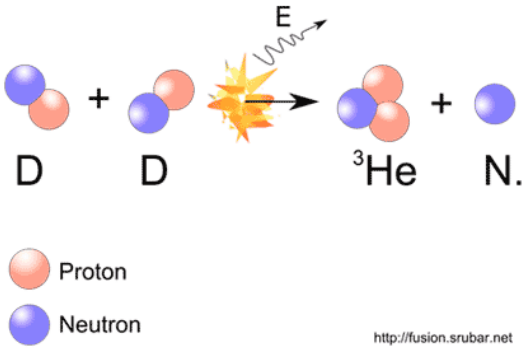
Used to be called “cold fusion” to signify comparatively low (near room) temperature

Hot Nuclear Fusion

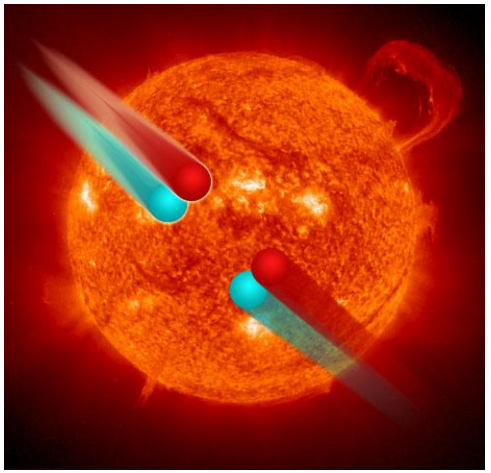
Uncontrolled Fusion



Deuterium - Deuterium Fusion



Controlled Fusion



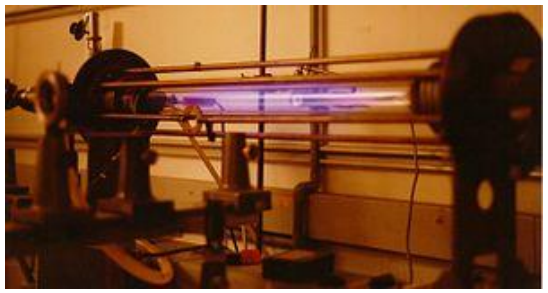
Controlled fusion require density-temperature-time minimums as given by Lawson criterion which have not been achieved yet.

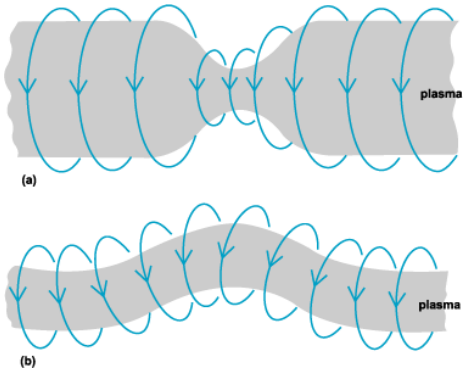
$$nT\tau > 3\times10^{21}\frac{keV\,\mathrm{sec}}{m^3}$$

Source: fusion.srubar.net, www.laradioactivite.com, www.chemistryland.com

Hot Fusion -50 and 25 years ago

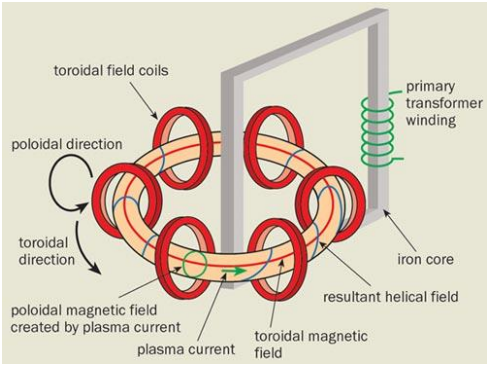
Pinch effect (50 years ago)

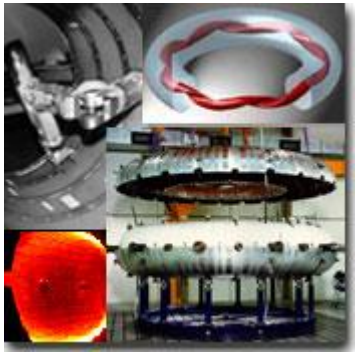


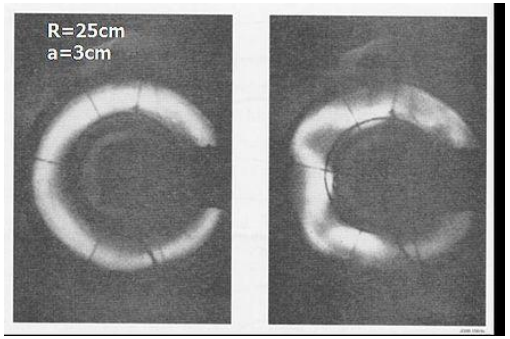


unstable

toroid pinch(25 years ago)





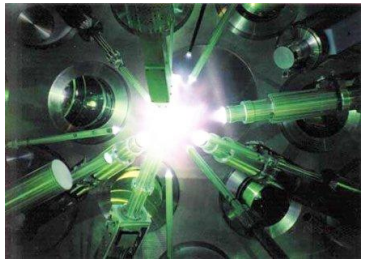


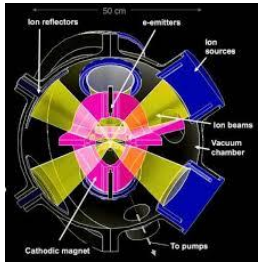
some stability achieved

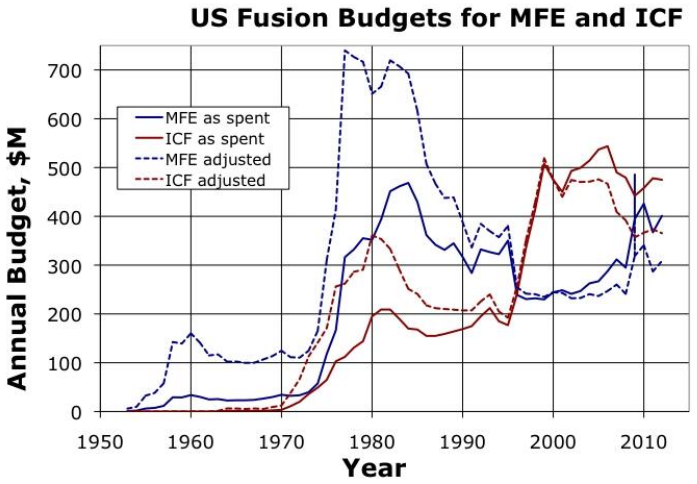
Source: www.wikipedia.org, physicsworld.com, www.thunderbolts.info

Current Approaches to Hot Fusion

Inertial Confinement

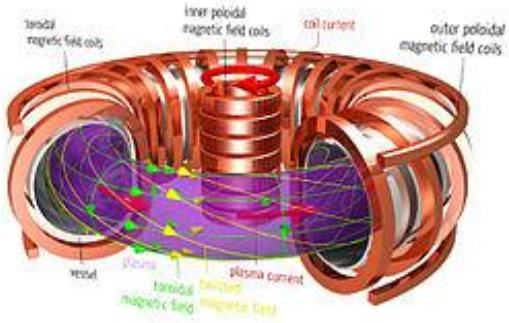


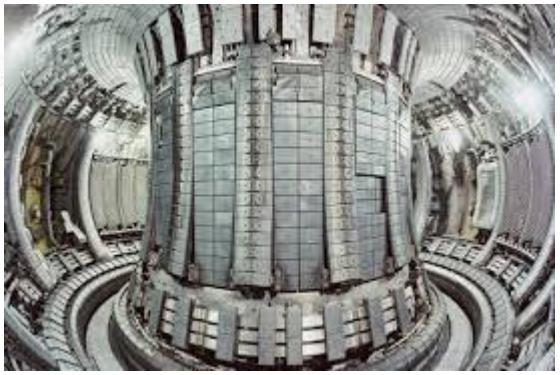




http://focusfusion.org/index.php/site/reframe/wasteful/

Tokomac.....ITER

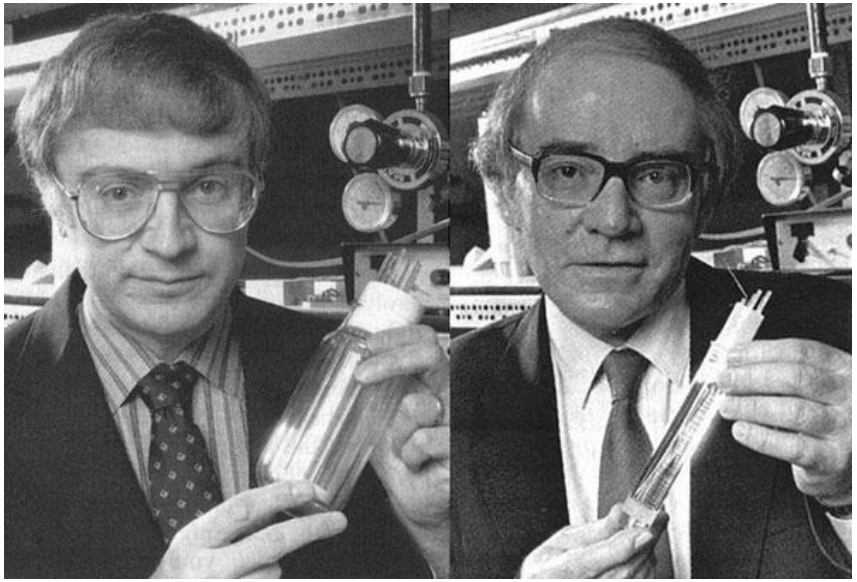


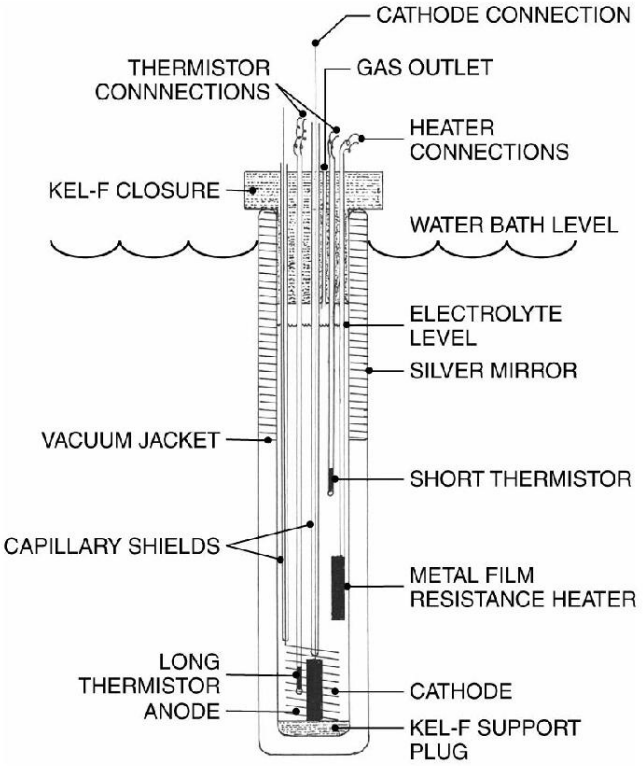


Source: www.wikipedia.org, ddiponzio.wordpress.com, ddiponzio.wordpress.com

And Along Came Cold Fusion (1989)

“Cold fusion is a hypothetical type of nuclear reaction that would occur at, or near, room temperature” Wikipedia





BEWARE if you value your academic career.

Source: www.wikipedia.org

Electrochemically induced nuclear fusion of deuterium

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Stanley Pons *

Department of Chemistry, University of Utah, Salt Lake City, UT 84112 (U.S.A.)

(Received 13 March 1989; in revised form 22 March 1989)

INTRODUCTION

The strange behaviour of electrogenerated hydrogen dissolved in palladium has been studied for well over 100 years, and latterly these studies have been extended to deuterium and tritium [1]. For discharge of deuterium from alkaline solutions of heavy water we have to consider the reaction steps

$$D_2O + e^- \rightarrow D_{ads} + OD^- \quad \text{(i)}$$

$$D_{ads} + D_2O + e^- \rightarrow D_2 + OD^- \quad \text{(ii)}$$

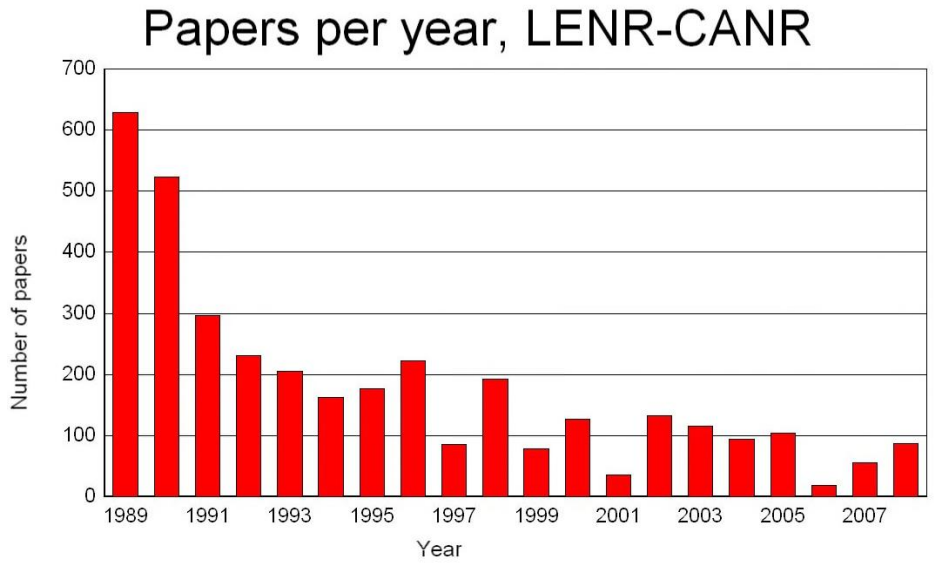
$$D_{ads} \rightarrow D_{lattice} \quad \text{(iii)}$$

$$D_{ads} + D_{ads} \rightarrow D_2 \quad \text{(iv)}$$

Journal of Electroanalytical Chemistry and Interfacial Electrochemistry, Volume 287, Issue 2, 25 July 1990, Pages 293–348

What happened to cold fusion?

Cold Fusion never did die. It went underground.



Cold Fusion was relabelled as LENR

- low energy nuclear reaction
- lattice enhanced nuclear reaction

Rothwell, J., *Tally of Cold Fusion Papers. 2009, LENR-CANR.org.*

LENR Status

Since 1989

- Numerous (>1500) LENR experiments
  - Deuterium palladium reaction in electrolytic cell
  - Hydrogen nickel reaction in electrolytic cell
  - Nickel, Lithium, Hydrogen in low temperature plasma or gas
- No solid explanation that covers all of the phenomena

LENR Status

- Yet be recognized as “legitimate” science
  - **Cold fusion** is a hypothetical type of nuclear reaction that would occur at, or near, room temperature, ... There is currently no accepted theoretical model which would allow cold fusion to occur. Source: www.wikipedia.org
- DOE this year allows funding for LENR in a disruptive technology funding program.
- In mid-October in France, Airbus is hosting a conference on anomalous effects of hydrogen in a metal lattice- a LENR conference in main stream science.

http://www.e-catworld.com/2015/07/01/airbus-to-host-lenr-workshop-in-october/

https://arpa-e-foa.energy.gov/FileContent.aspx?FileID=1c56ac4a-0acd-43ee-a2ec-ab80b33f4146

LENR Commercialization E-Cat

Andrea Rossi (Italy) attempted to commercialize and LENR reactor E-Cat

- Based on the LENR Transmutation of Nickel with the release of energy
- No viable reaction mechanism proposed

Technology rights sold to Industrial Heat of North Carolina (Jan 2014)

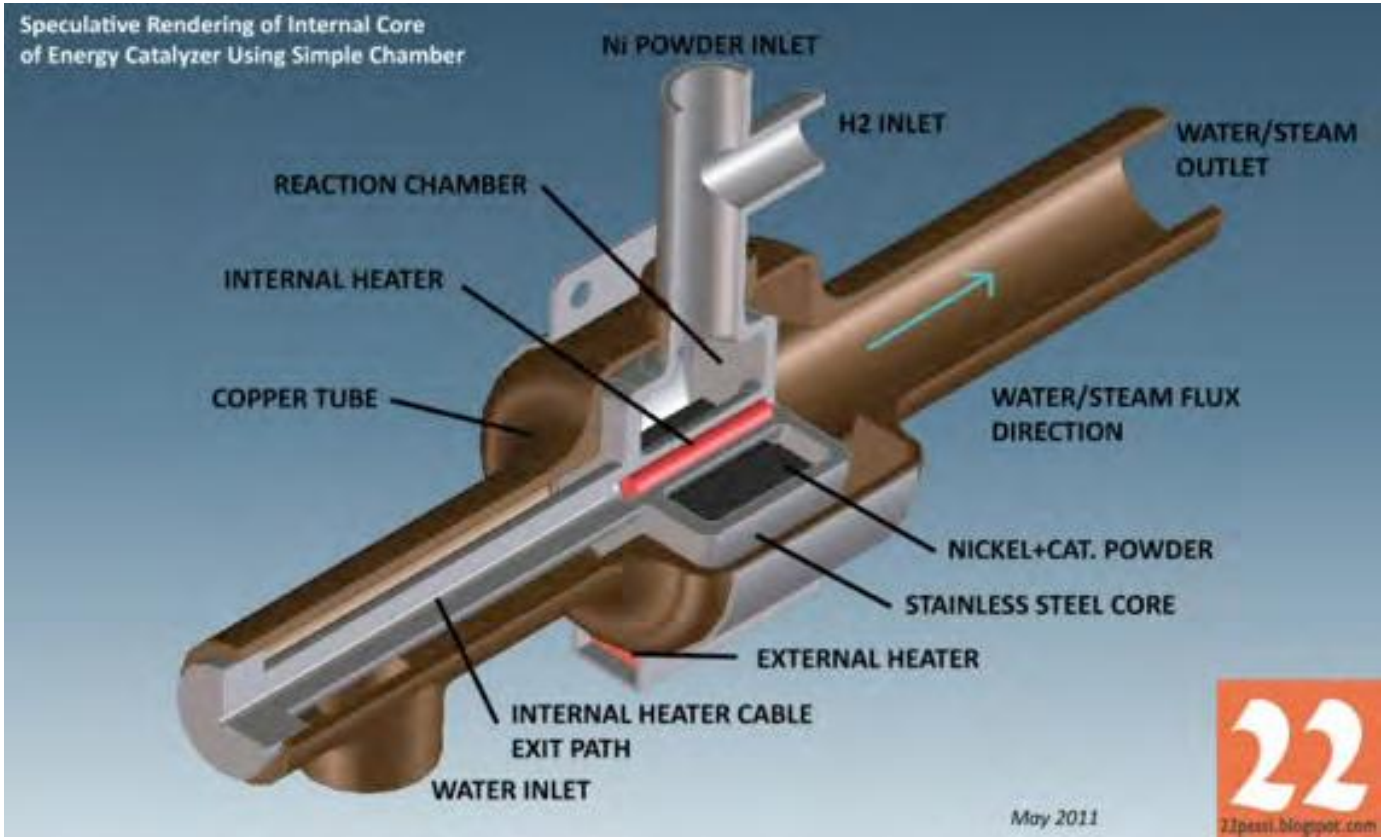
Italian Technology Company TSEM to Collaborate with MIT, Texas Tech University and Industrial Heat in the US (June 2015)

Norway's Aftenposten Newspaper: Independent Confirmation Rossi's 1MW Plant Working

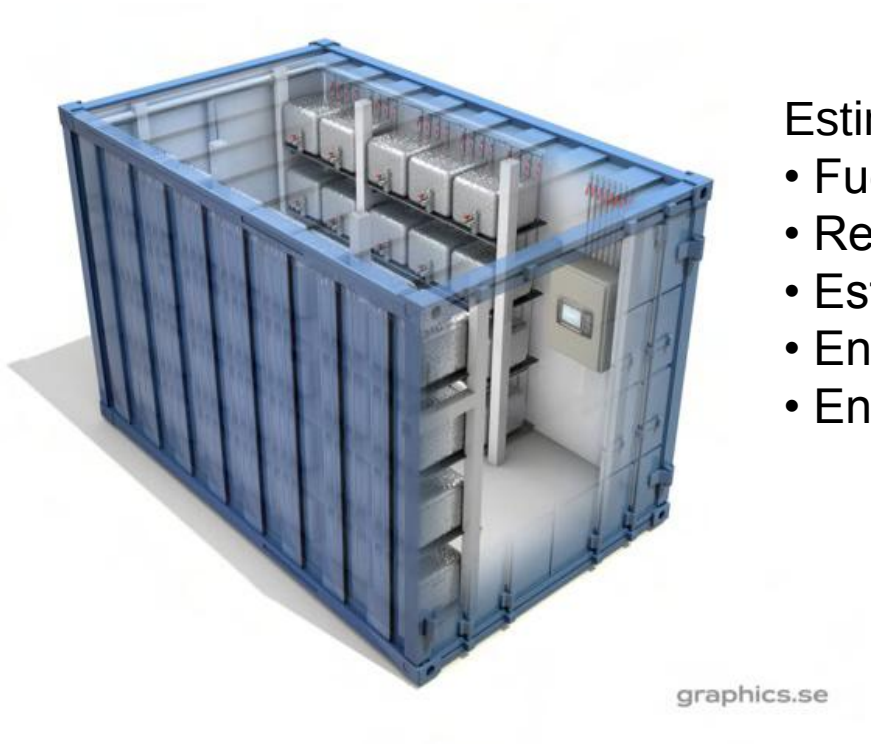
- Source with 'Heavy Scientific Background' has Inspected Plant Posted, June 21, 2015

E-Cat Hardware

Italian patent number BO2010E000076



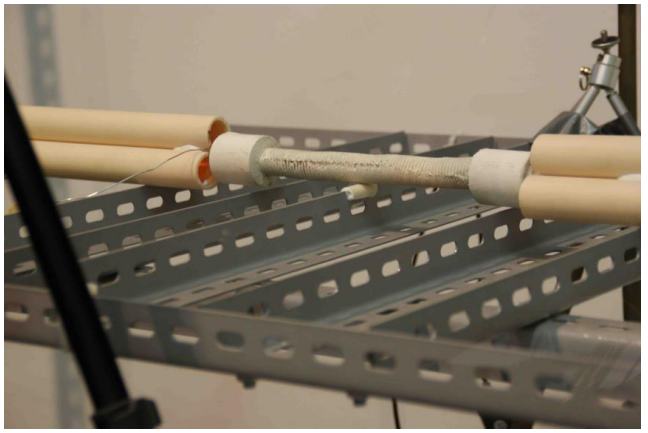
E-Cat Hardware

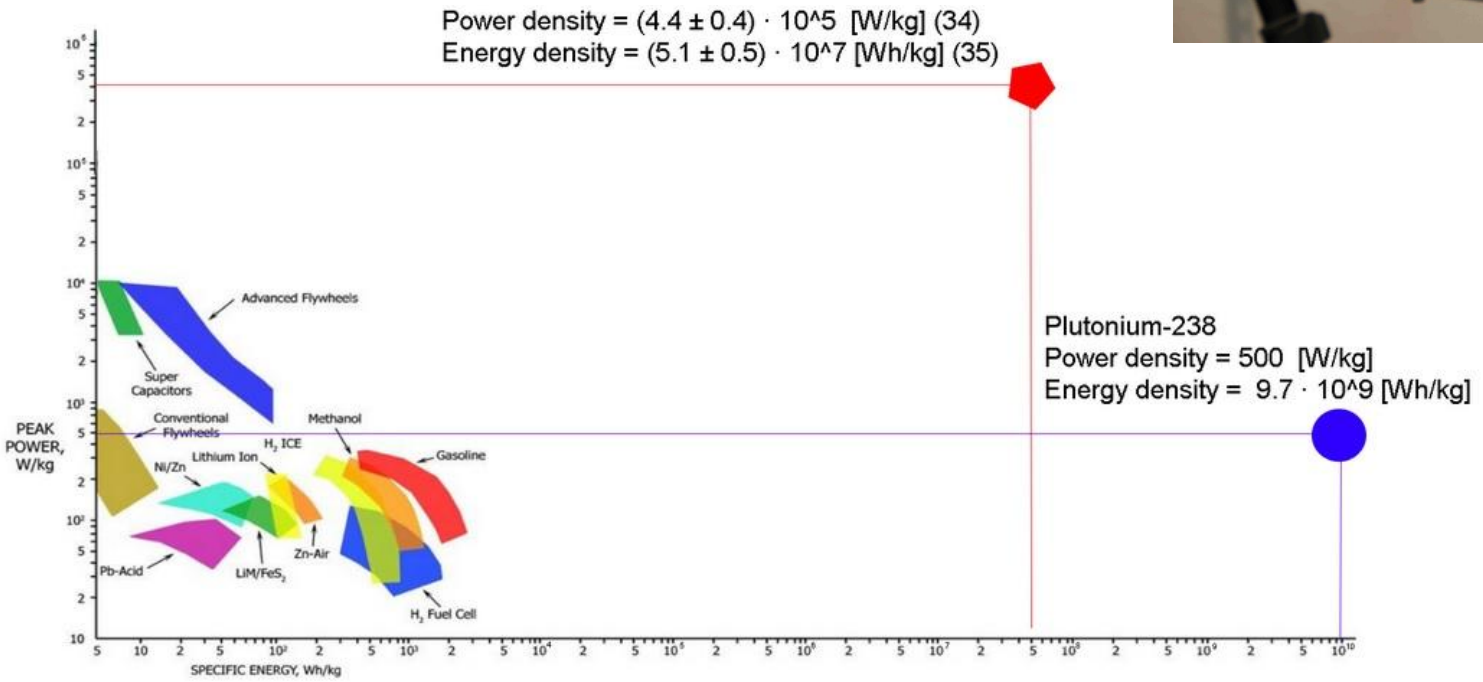


Estimated Operation Characteristics
- Fuel Cost $1/MWhr (0.11 cent/kWhr)
- Recharge frequency: twice per year
- Estimated lifespan: 30 years
- Energy output comparison (100 000 x oil)
- Energy reserves (10 billion years)

Source: ecat.com/ecat-products/ecat-1-mw

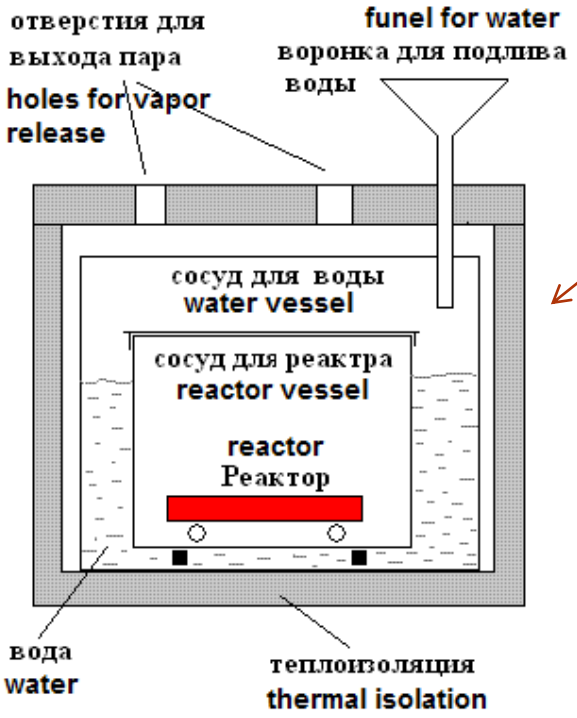
E-Cat Reactor



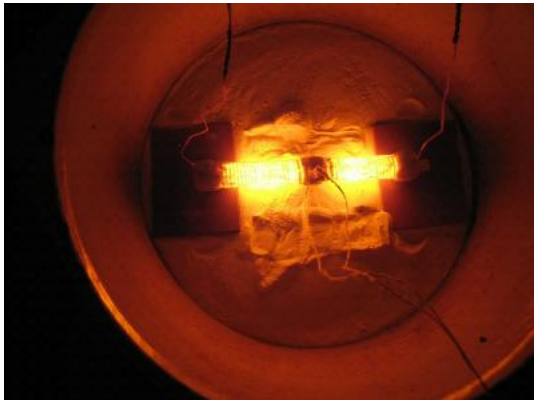


Giuseppe Levi, et. al., Observation of abundant heat production from a reactor device and of isotopic changes in the fuel, http://www.elforsk.se/Global/Omv%C3%A4rld_system/filer/LuganoReportSubmit.pdf

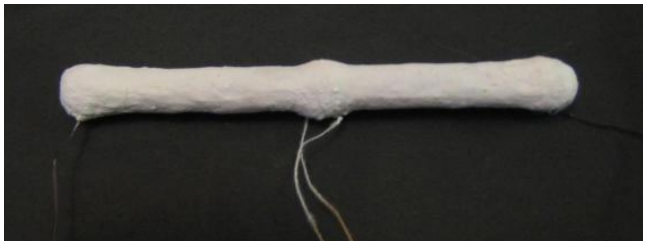
Parkhomov Copy-Cat

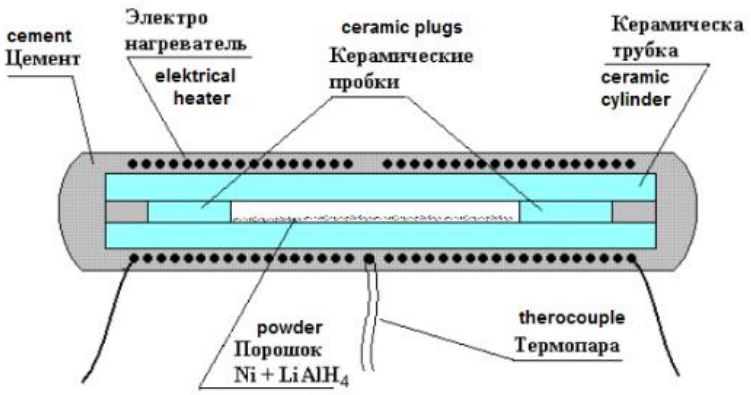


Reaction Chamber



Reaction Vessel





https://yadi.sk/d/_agVKcYdg5GdH

E-Cat Fuel

Nickel

- no proof that reducing the particle size enhances the excess heat effect
- 90% Ni - by weight
- 2 to 20 μ or larger particle size

Lithium Aluminum Hydride - $Li\,Al\,H_4$

Non-Essential (?) Additives

- Mg, Fe, Ca, Mn
- Are they non-esssential?

Hank Mills ,Guideline Document for Basic Nickel-Lithium Aluminum Hydride Reactor Based on Rossi's E-Cat, http://www.e-catworld.com/2015/04/25/guideline-document-for-basic-nickel-lithium-aluminum-hydride-reactor-based-on-rossis-e-cat-hank-mills/

As the Fuel Heats Up

$Li\ Al\ H_4$ begins to melt at 150 °C .

$3\ LiAlH_4 \rightarrow Li_3AlH_6 + 2\ Al + 3\ H_2\ (150\ °C)$
$2\ Li_3AlH_6 \rightarrow 6\ LiH + 2\ Al + 3\ H_2\ (200\ °C)$

At 400°C the material becomes a lithium aluminium alloy plus gaseous hydrogen.

$2\ LiH + 2\ Al \rightarrow 2\ LiAl\ (alloy) + H_2\ (400°C)$

At 1347°C the lithium boils out of the alloy.

At the operating temperature of the reactor, if above 1350°C, the following is the overall reaction

$Li\ Al\ H_4 + energy \rightarrow Li(g) + Li(l) + Al(l) + H_2(g) + 2H(g)$

http://en.m.wikipedia.org/wiki/Lithium_aluminium_hydride

Summary of Experimental Findings

Element	Abundance in Fuel	Abundance in Ash
Li	1.17	0.03
Ni	55.0-55.4	95.5-95.6
Al	4.36-4.39	0-0.5
C, Ca, Cl, Fe[(1)],Mg,Mn	39.04-39.47	4.32-4.47

*Iron oxide may be indicated
Copper may be indicated

Giuseppe Levi, et. al., Observation of abundant heat production from a reactor device and of isotopic changes in the fuel, http://www.elforsk.se/Global/Omv%C3%A4rld_system/filer/LuganoReportSubmit.pdf

Fuel Isotope Analysis

Ion	Fuel (SEM/EDS)	Fuel (ICP-MS)	% Ash	Ash (ICP-MS)
$^{6}Li^{+}$	8.6	5.9	92.1	57.5
$^{7}Li^{+}$	91.4	94.1	7.9	42.5
$^{58}Ni^{+}$	67	65.9	0.8	0.3
$^{60}Ni^{+}$	26.3	27.6	0.5	0.3
$^{61}Ni^{+}$	1.9	1.3	0	0
$^{62}Ni^{+}$	3.9	4.2	98.7	99.3
$^{64}Ni^{+}$	1	-	0	-

Giuseppe Levi, et. al., Observation of abundant heat production from a reactor device and of isotopic changes in the fuel, http://www.elforsk.se/Global/Omv%C3%A4rld_system/filer/LuganoReportSubmit.pdf

What May Be Happening

(1)[1] $^{7}Li + p + 2.26MeV \rightarrow {}^{7}Be + n$

$^{7}Be + e \rightarrow {}^{6}Li + p + .86MeV$

(2)[2] $^{58}Ni + n \rightarrow {}^{59}Ni + MeV ..... + n \rightarrow {}^{63}Ni + MeV$

(3)[3] $^{a}Ni + p + MeV \rightarrow {}^{a+1}Cu \rightarrow {}^{a+1}Ni + e^{+} + MeV$

[1]C.L. Lee , X.-L. Zhou ,Thick target neutron yields for the 7Li(p,n)7Be reaction near Threshold,. Nuclear Instruments and Methods in Physics Research B 152 (1999) 1-11

[2]**Thermal and Resonance Neutron Capture in Copper, Nickel, and Manganese,**. A. Wasson and J. E. Draper, Phys. Rev. **137**, B1175 – Published 8 March 1965

[3]On the Nuclear Mechanisms Underlying the Heat Production by the E-Cat,Authors: Norman D. Cook, Andrea Rossi,http://arxiv.org/abs/1504.01261

Hydrogen Ion Concentrations

Temperature Dependence of Hydrogen Species Concentration

Concentration*	1400°C	3000°C	4500°C	6000°C
H_2	99	99	85	42
H	10^{-4}	0.9	15	58
H^+	0	10^{-11}	10^{-7}	10^{-5}

*calculated using Saha equation

Conclusion

Most likely proton source would be molecular hydrogen

"An Analysis of Low Energy Nuclear Reactions in the E-Cat Device", Douglas W. Lindstrom, Horst Eckardt, Steven Bannister, to be published

Summary of Experimental Findings

Thermite Reaction (Reason for Iron?)

$$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe + 850000\ J/mole$$

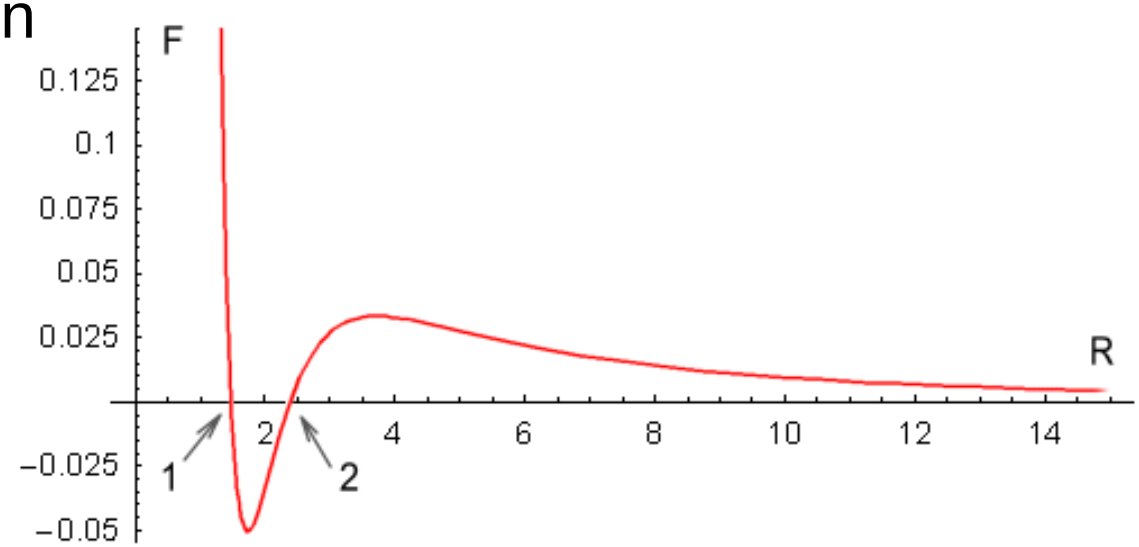
- Self-starting above 600 °C
- May get reactor hot spots to 3000 °C

Source: www.twcenter.net

Standard Model Explanation

Problem is that electrostatic repulsion forces as two nuclei approach are very large until strong force kicks in

- Li + proton
- Ni + proton



LENR and ECE - an example

- Consider following tentative LENR reaction

$$^{7}Li + p + 2.26MeV \rightarrow {}^{7}Be + n$$

$$^{7}Be + e \rightarrow {}^{6}Li + p + .86MeV$$

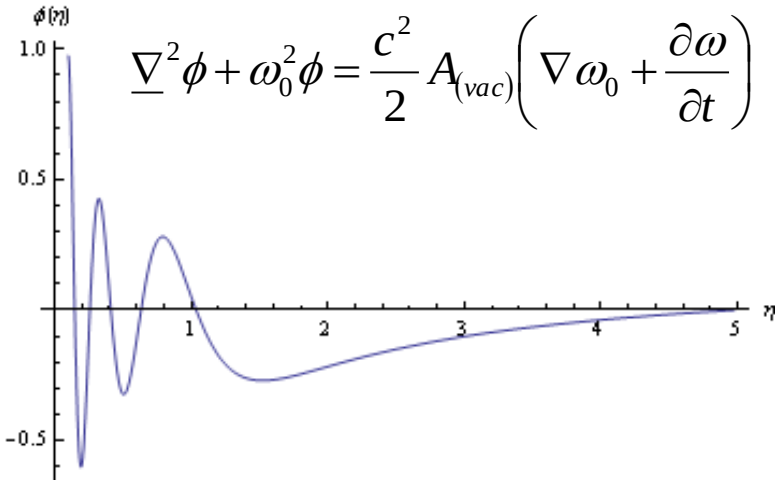
- ECE can explain this on several levels
  - Non-relativistic quantum tunneling of proton dragging a quantized electromagnetic potential into the nucleus with it.
  - Relativistic quantum tunneling with electromagnetic potential again dragging a quantized electromagnetic potential into the nucleus
  - ECE impact theory incorporating change of mass, electromagnetic effects, space time curvature
  - Enhanced proton potential using vacuum state resonance(eg. modifed Storms model)

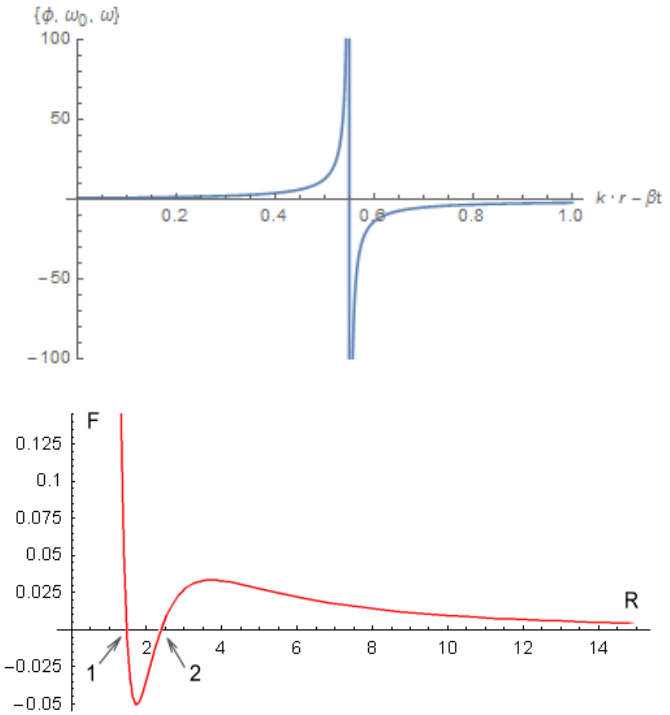
Does ECE Resonance Explain LENR?

ECE explains LENR using a Coulomb resonance

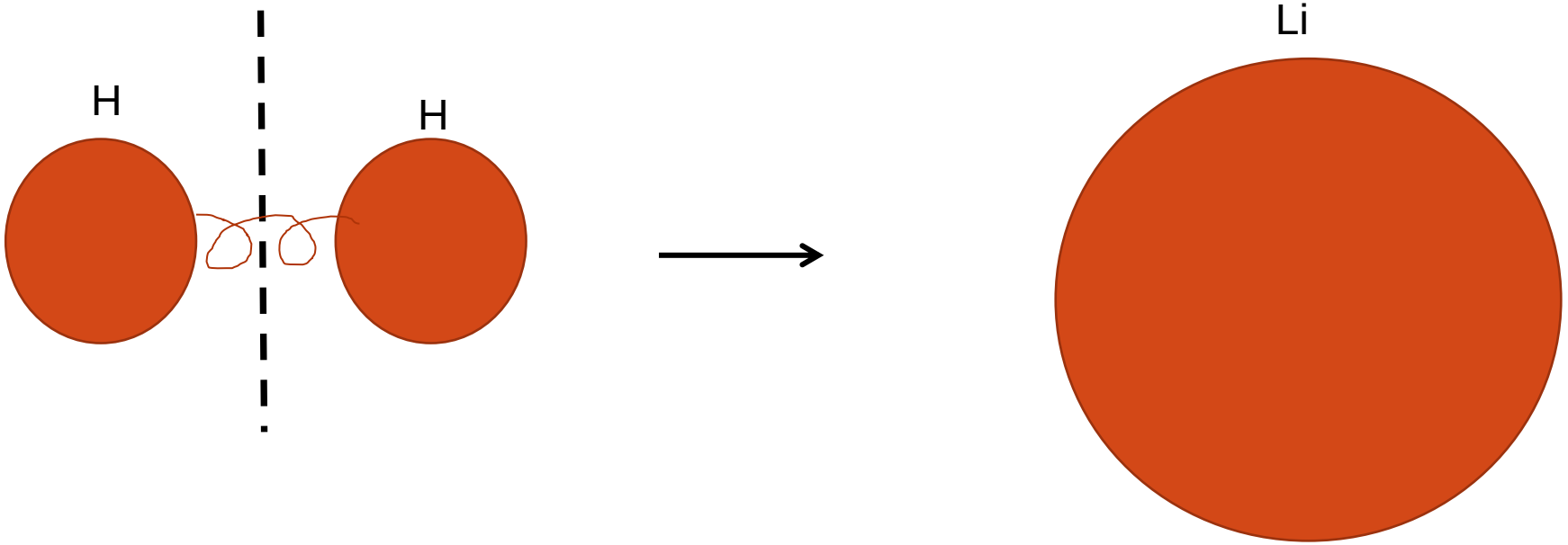
- "Principles of ECE", Evans, Eckardt, Lindstrom, Crouters, soon to be published

$$\nabla^2\phi + \omega_0^2\phi = \frac{c^2}{2} A_{(vac)}\left(\nabla\omega_0 + \frac{\partial\omega}{\partial t}\right)$$





Diatomic Hydrogen Model



$$\underline{\nabla}^2\phi + \omega_0^2\phi = \frac{c^2}{2} A_{(vac)}\left(\nabla\omega_0 + \frac{\partial\omega}{\partial t}\right) \rightarrow \nabla^2 V_c + \omega^2 V_c = A^{(vac)} \cdot \left(\nabla\omega_0 + \frac{\partial\omega}{\partial t}\right)$$

$$\theta = Exp\frac{\sqrt{2\mu V_0}}{\hbar}\int_a^b \left(\frac{-1}{1+Exp[\frac{r-R}{a}]} + V_c - \lambda\right)^{1/2} dr \rightarrow \mathrm{T} \approx \frac{4}{\left(2\theta + \frac{1}{2\theta}\right)^2}$$

What's Needed For ECE-LENR

Need for more powerful finite element software and hardware

- Comsol, FlexPde, Mathematica

$$\underline{\nabla}^2\phi + \omega_0^2\phi = \frac{c^2}{2} A_{(vac)}\left(\nabla\omega_0 + \frac{\partial\omega}{\partial t}\right) \quad \Rightarrow \quad \nabla^2 V_c + \omega^2 V_c = A^{(vac)} \cdot \left(\nabla\omega_0 + \frac{\partial\omega}{\partial t}\right)$$

$$\mathrm{T} \approx \frac{4}{\left(2\theta + \frac{1}{2\theta}\right)^2} \quad \Leftarrow \quad \theta = Exp\frac{\sqrt{2\mu V_0}}{\hbar}\int_a^b \left(\frac{-1}{1+Exp[\frac{r-R}{a}]} + V_c - \lambda\right)^{1/2} dr$$

Topics Covered

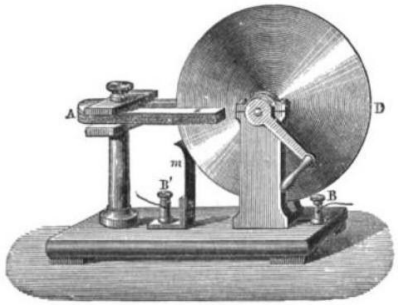
Brief history of physics and a look forward

Explanation of ECE theory

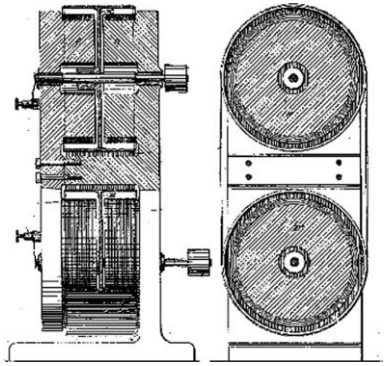
Applications of ECE theory

- LENR-ECAT
- Homopolar generator
- Osamu Ide experiment
- ET3M - Mexico

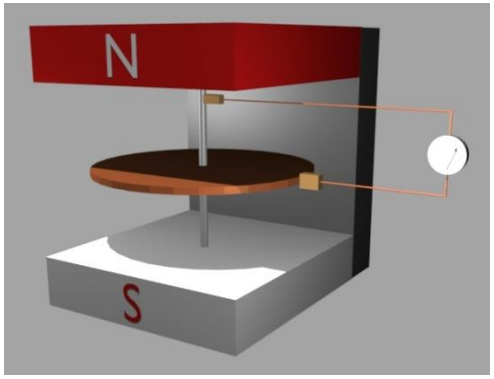
Homopolar (Faraday Disk)Generator

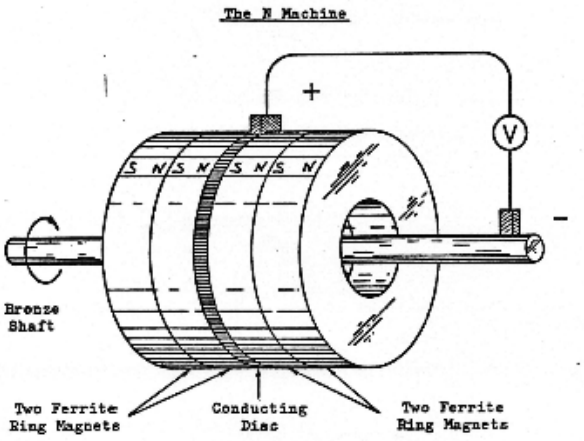


Faraday Disk Generator



Tesla's Homopolar Generator



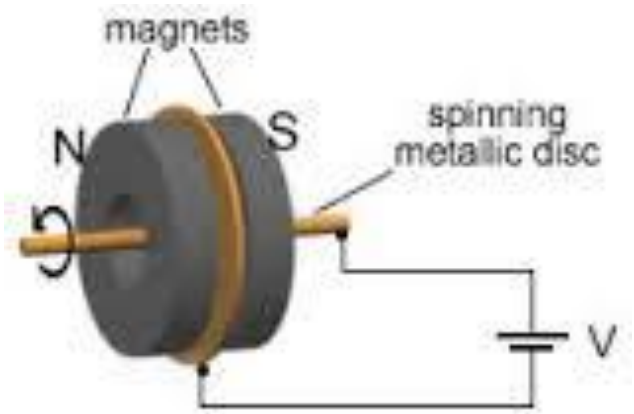


Source: www.physforum.com, www.bibliotecapleyades.net

Homopolar Generator-Modern Experiments

Sir Mark Oliphant

- Australian National University (1951-1964)
- Unsubstantiated accounts of rotor explosions



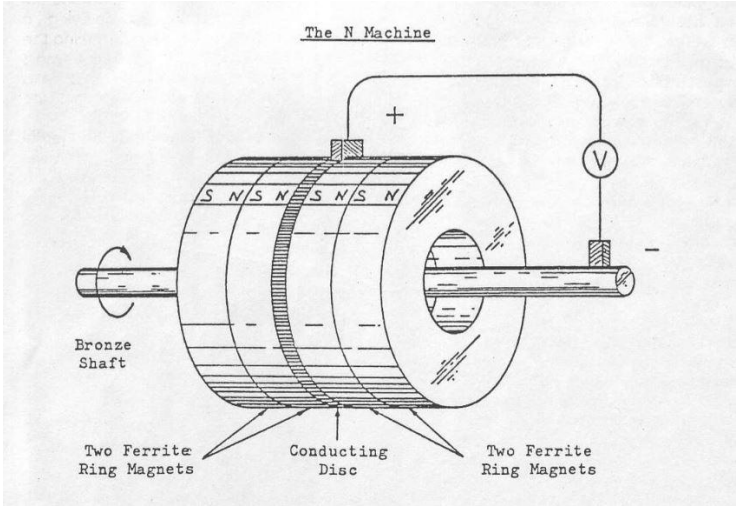
https://en.wikipedia.org/wiki/Mark_Oliphant

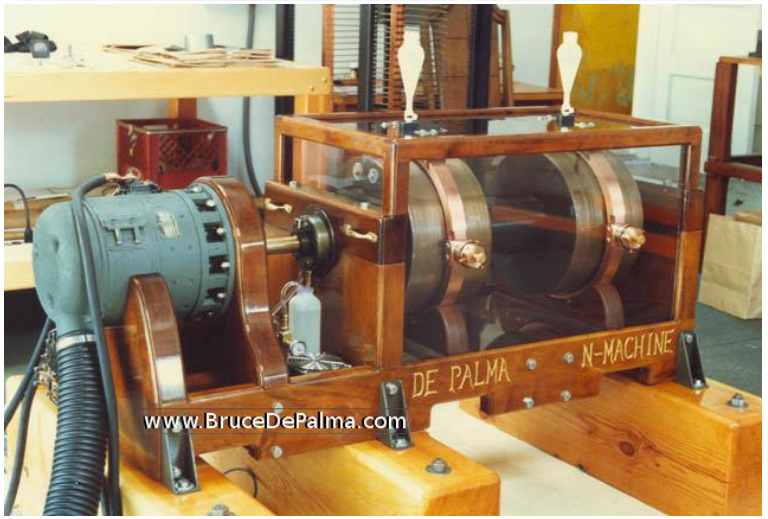
Homopolar Generator-N machine

De Palma is a name associated with the N machine.

Sunburst was perhaps the largest N machine built and analyzed by independent professional staff

Replication has been underway in several locations for several years now. According to Puthoff, results are still inconclusive.





N-Machine and Bruce DePalma, http://brucedepalma.com/n-machine

Homopolar Generator-ECE Explanation

$$\frac{\partial^2 A}{\partial t^2} + i\Omega\frac{\partial A}{\partial t} + i\frac{\partial \Omega}{\partial t}A = \frac{J}{\varepsilon_0}$$

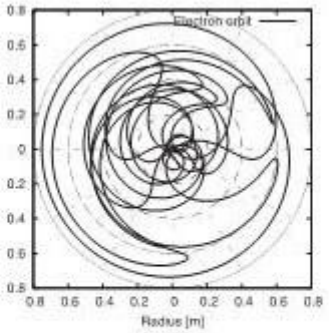


Fig. 14.12. Electron orbit for all force components.

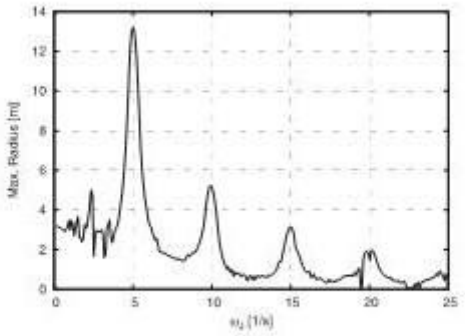


Fig. 14.13. Resonance curve of max. radius for variable current frequency ω_J.

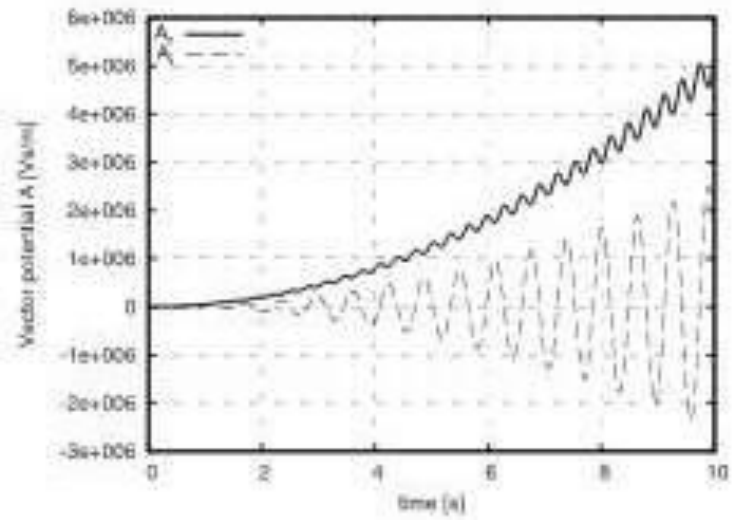


Fig. 14.1. Vector potential for $\alpha_0 = 5$, $\omega_0 = 10$, $\omega_J = 0$.

Myron W. Evans, F. Amador and Horst Eckardt, Spin Connection Resonance in the Faraday Disk Generator, http://www.aias.us/documents/uft/paper107.pdf

Achieving the vacuum resonance

For non-Maxwellian state to exist, we need:

- multivalued potentials – pulses, spikes
- boundaries that move in response to the electromagnetic fields
- inductances, capacitances, etc. that depend on electromagnetic field values (parametric)
- Positively (or negatively) biased potentials

Topics Covered

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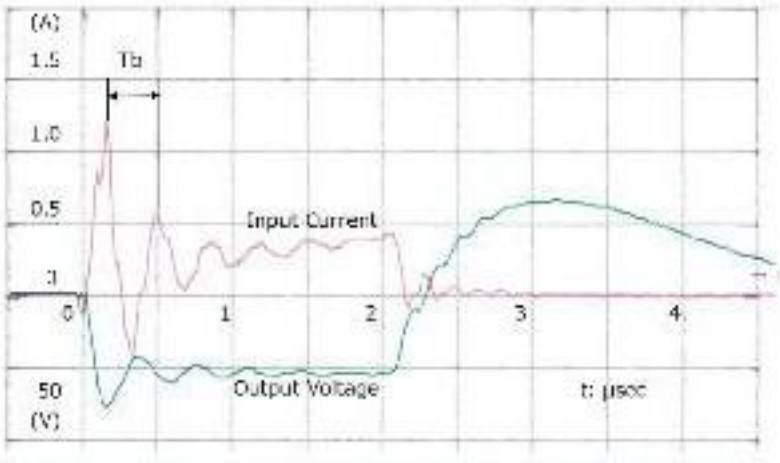
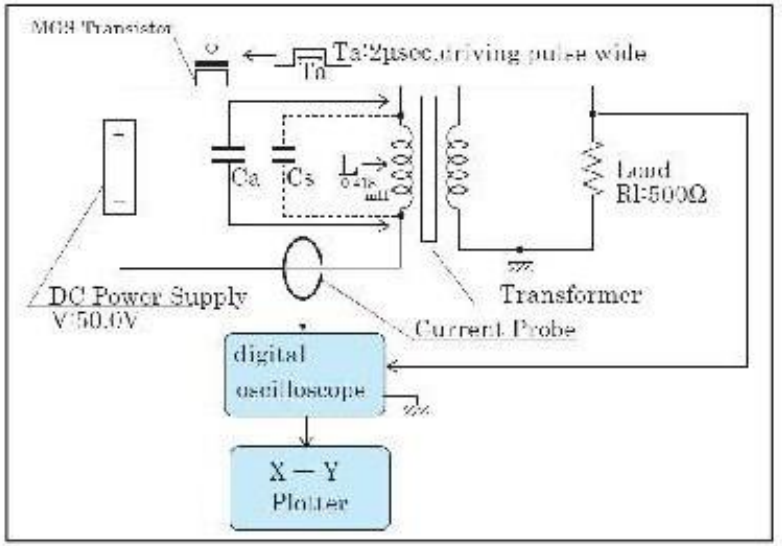
Osamu Ide Experiment

Osamu experiment

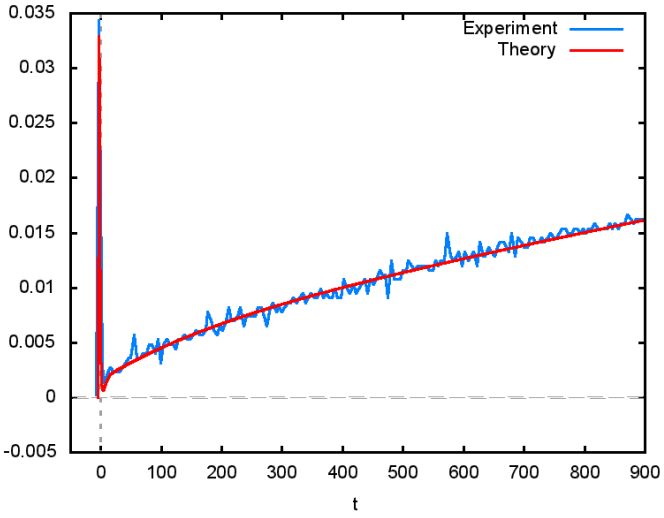
- Ferrite core inverter
  - anomalies
    - Negative blip at t=0
    - Positive dc output component





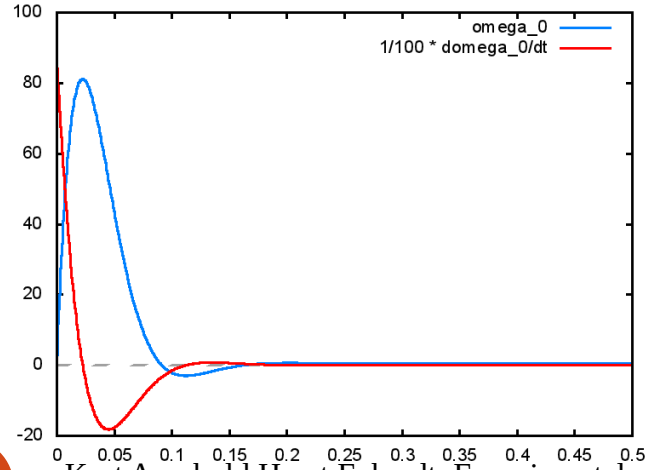
Osamu Ide, Canadian Patent Application, CP2793435
Osamu Ide et. al., Consideration of the cause of inverter called ringing, to be published
Osamu Ide et. al, Anomalous rising of input current in the transformer of inverter , to be published
Osamu Ide, Characteristics of DC power output from an inverter driven by sharp spike pulse , to be published

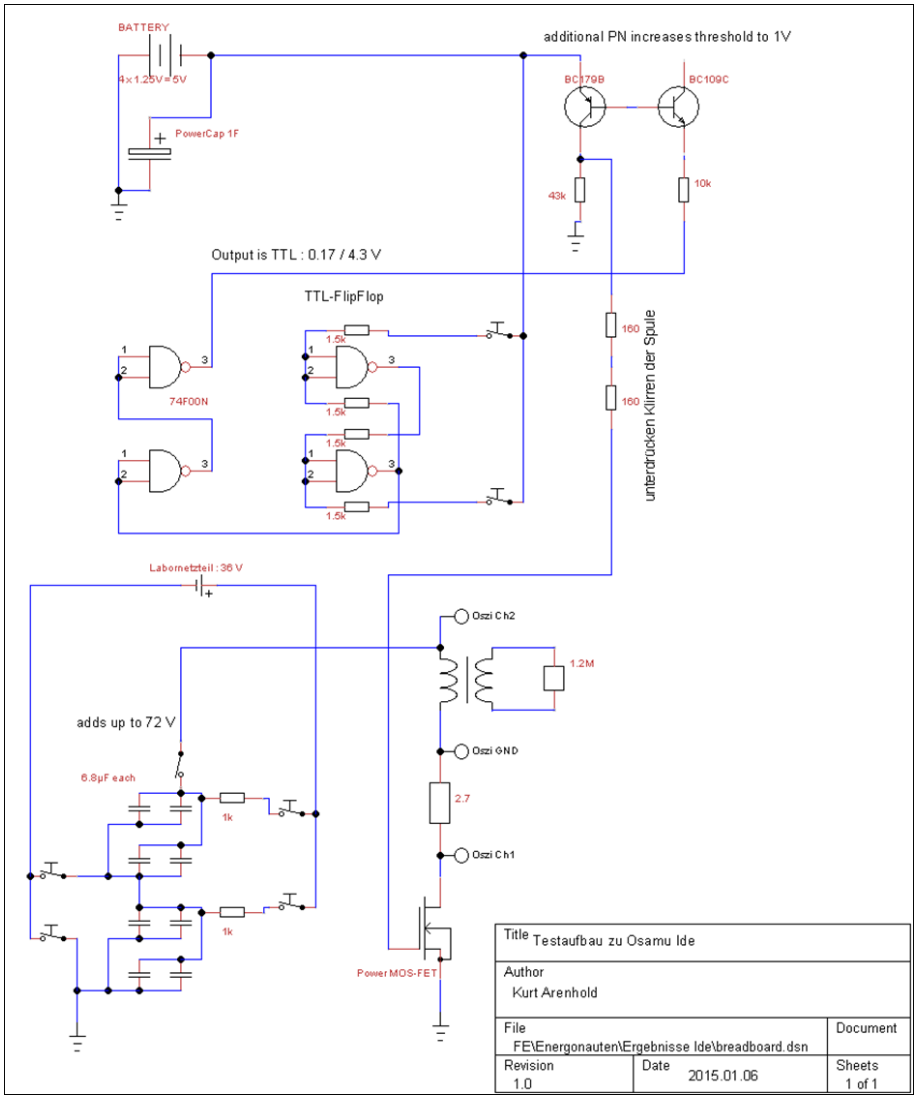
Arenhold-Eckardt Verification and Explanation



$$A_r'' + \omega_0' A_r + \omega_0 A_r' = -E_{r(driving)}'$$

$$A_\varphi'' + \omega_0' A_\varphi + \omega_0 A_\varphi' = -E_{\varphi(driving)}'$$





Kurt Arenhold,Horst Eckardt ,Experimental verication and theoretical explanation of the Osamu Ide experiment, http://www.aias.us/documents/uft/UFT311_IdeExp.pdf

Designing for Unusual Inductive Behaviour[1]

In general a series resonant circuit obeys

$$\frac{d}{dt}(LI)+RI+\int\frac{I}{C}dt=U_0$$

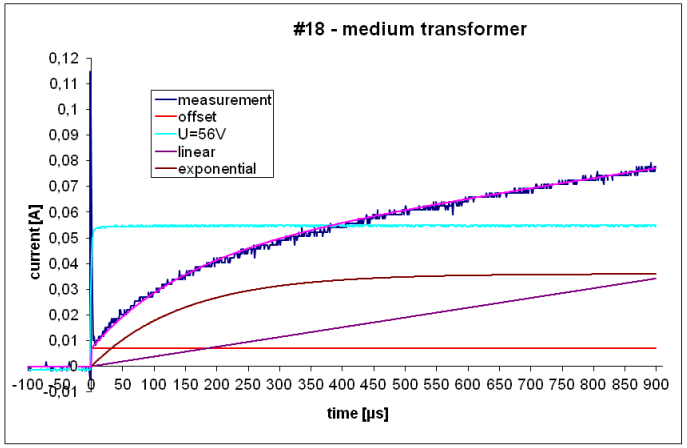
This can be rewritten

$$L\frac{d^2Q}{dt^2}+\left(\frac{dL}{dt}+R\right)\frac{dQ}{dt}+\frac{Q}{C}=U_0$$

[1]Horst Eckardt, Douglas Lindstrom, Circuit theory for unusual inductor behaviour, to be published.

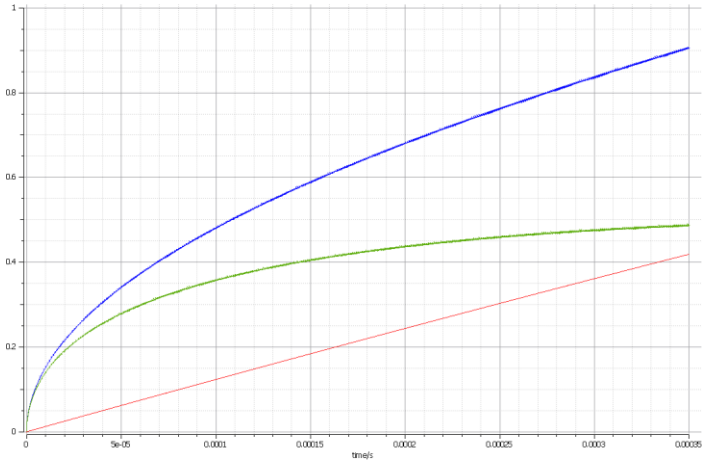
Simulation Results

$$L(t) = L_0\left(1 - e^{-\frac{t}{\tau}} Sin(\omega t)\right)$$



- Seems to explain Ide and Arenhold data

- May be way to design parametric circuits
  - find device parameters needed using non-linear circuit
  - design device using ECE equations



Next Step

Determine if effects are ground state generated through energy calculations.

Laboratory equipment

- High resolution pulse sampling
- Accurate pulse generating equipment

Computer hardware and software for finite element modelling of components.

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Mexico – ET3M

- Who are they
- Affiliation with AIAS
- Video
  - http://www.et3m.net/Updates.html

Conclusions

Justified why new physics paradigm is needed

Explained ECE theory in as non-mathematical way that I know how to

Demonstrated application of ECE theory to four "over unity" devices that are not explainable using the standard model of physics.

Questions?

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www.AIAS.US