

GALILEAN ELECTRODYNAMICS

Experience, Reason, and Simplicity Above Authority

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EDITORIAL POLICY

Galilean Electrodynamics aims to publish high-quality scientific papers that discuss challenges to accepted orthodoxy in physics, especially in the realm of relativity theory, both special and general. In particular, the journal seeks papers arguing that Einstein's theories are unnecessarily complicated, have been confirmed only in a narrow sector of physics, lead to logical contradictions, and are unable to derive results that must be postulated, though they are derivable by classical methods.

The journal also publishes papers in areas of potential application for better relativistic underpinnings, from quantum mechanics to cosmology. We are interested, for example, in challenges to the accepted Copenhagen interpretation for the predictions of quantum mechanics, and to the accepted Big-Bang theory for the origin of the Universe.

On occasion, the journal will publish papers on other less relativity-related topics. But all papers are expected to be in the realms of physics, engineering or mathematics. Non-mathematical, philosophical papers will generally not be accepted unless they are fairly short or have something new and outstandingly interesting to say.

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The journal most values papers that cite experimental evidence, develop rational analyses, and achieve clear and simple presentation. Papers reporting experimental results are preferred over purely theoretical papers of equally high standard. No paper seen to contradict experiment will be accepted. But papers challenging the current interpretation for observed facts will be taken very seriously.

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From the Editors' files of Important Letters:

Philosophizing about Natural Philosophy

This essay analyzes the significance of the Lorentz-Poincaré coordinate-conversion when regarded as a purely mathematical instrument, compared with its significance when interpreted as *translator of physical realities*. This essay is intended as a preliminary approach to a more significant investigation of inertia and gravitation modeled in terms of an aether.

1. Preliminary. Richard Feynman defined the phrase '*to understand*' as "*the ability to apply acquired knowledge in new circumstances*" [1]. In the present essay '*understanding*' is treated in a different, perhaps more particular, way. Essentially, '*understanding*' is regarded as a cerebral process by which *mental models*, meaning *virtual representations* corresponding to the real world, are configured.

The consequence of such an approach is that, whatever way one tries to understand the existence and/or evolution of a system, one should begin with a search for a representative model of the phenomenon of interest. Since such an approach presupposes configuring something logically new, not yet well understood, the process necessarily involves structuring into something virtual. So, an attempt to understand how the Universe really runs should start with imagining a representative model of the implied '*thing*'.

In the present essay, one compares the actual, the usual mode physics is understood relative to a non-conformal conception developed on a two-fold basis:

- a) the *faith* that human reasoning based on intuitive models is more natural than speculation with nonfigurative entities in a non intuitive space,
- b) the belief that no physical world can exist, even less run, on pure "*space*" alone (meaning simple Euclidian geometric space), nor even on the more complex "*space-time*" as it is presupposed in the "genuine RTS".

Thought of this way, any functional system must be imagined supported by a medium, *substantial* and spatially-continuous, capable to *transmit or to transfer energy*. Newton, while endeavoring to configure his celestial dynamics, mentioned this medium, denominating it "*aether*". In this intent he imagined an abstract model running on aether inflowing, *continuously*, into matter. Seemingly, it is the first time a physical model not quite well enough imagined to adequately translate the realities [2], [3], is afterwards alternately formalized, succeeding so to achieve an adequate *representation* of the phenomena. It happened that Newton's aether model was forgotten, while his mechanics is still in general use and his theory of gravitation stood firm for centuries, until Albert Einstein challenged it via his GRT, a powerful construct essentially based on SRT.

SRT is nonetheless precarious, because built on an inconsistent logic base. Surprisingly, even if many scientists know that, the SRT remained strongly supported by most of the world's top physicists for more than a century now.

How could this anomaly be explained?

An answer may be found in the similar way Einstein and Newton validated their theories: *the logic of the thought model is somehow precarious, yet, accidentally, the mathematic formalism representing the physical process is adequate*. Or, more precisely expressed and motivated:

Continued on page 9

Reactive and Support-less Movement: Electrodynamic Propulsion

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Reactive jet and electrodynamic propulsions are here analyzed. It is shown that reactive forces are developed from non-compensated forces, not from jet reaction, which is even more obvious for electrodynamic (electromagnetic) thrusters. It is shown that some electrodynamic thrusters using an internal magnetic field can operate in a reactionless manner. Also, it is shown that photonic propulsion engines and radio antennas having asymmetrical directional pattern can operate as reactionless thrusters.

1. Introduction

Even though official science proclaims that supportless, or reactionless, movement does not exist because it contradicts Newton's First Law, this issue arises from time to time because of the development of some new mechanical/electrodynamic apparatus, that, according to its authors, operates in a reactionless manner. After detailed analysis, some of these inventions appear as ordinary reactive machines, but the operational principles of some of them look like real reactionless propulsion; and it can be utilized in reactionless thrusters operating without jettisoning any of its parts, and so without any reactive jet. One of these thrusters, an Electrodynamic Capacitor Thruster – is the subject of this article.

2. Briefly About Rocket Propulsion

Let us recall briefly the classic example of a reactive machine: a rocket engine.

It is known that the thrust of a rocket engine can be determined in two ways [1-3]:

- 1) From the equation of impulse of force in Euler's form;
- 2) From the integral of pressure applied to a thrust chamber and nozzle.

In the first case, the force of thrust is derived from the equation of impulse of force in Euler's form:

$$d(mV) = Fdt \quad (2.1)$$

So, the force of rocket thrust will be defined by the formula:

$$F = V \, dm / dt \quad (2.2)$$

where V is the jet velocity, and $dm / dt = \dot{m}$ is the mass flow rate. This formula is valid only for the so-called 'operational mode' of the rocket engine, where static pressure of the exhaust (nozzle exit pressure) is equal to atmospheric ambient pressure.

The second approach is to determine the non-compensated force applied to the thrust chamber and nozzle. In this case, the integral of forces applied to inside and outside of the thrust chamber walls is calculated, and the difference between these forces is the thrust.

This case can be illustrated by following example. Assume that we have a tank under gas pressure. The walls are stretched

equally, so all forces applied to tank's walls are compensated and the tank does not move. Make a hole in the wall. In the result the force that is equal to surface of the hole multiplied by tank's pressure (difference between tank's pressure and outside pressure) becomes non-compensated, so the tank starts working as a rocket engine. This force is known as the 'major' part of the thrust. If tank's pressure is maintained, it will continuously work as a rocket engine. This explanation is the very brief one, because it does not take in account declination of static gas pressure under acceleration in pre-sonic part of the chamber and supersonic nozzle. Because of this, the thrust of real rocket engines exceeds the 'major' part of the thrust by 1.3 to 2 times.

Also, the thrust does not depend (approximately) on the substance that provides pressure in the thrust chamber – it can be hot or cold compressed gas and even water – just need to keep pressure inside the thrust chamber. It means that the jet developed by the thrust chamber does not have any relation to the thrust development and the thrust is not reaction on the jet; but to keep pressure it is necessary to continuously feed the chamber by gas, which flow rate very depends on thermodynamics properties of the gas. Further, the hot gas (exhaust) is expanding and transformed into a jet, and, in many cases, kinetic energy of the jet is equal to kinetic energy propelling the rocket. So, to keep the pressure inside the thrust chamber, the rocket has to store propellant and its volume directly depends on thermodynamics characteristics of the propellant.

Such argument is valid only for a rocket that takes all propellant on board. Rocket specialists use a term 'specific impulse' (I_{sp}), which represents the force with respect to the amount of propellant used per unit time. For the best rocket engines it is up to 450, but, if part of propellant is taken from outside, this value enormously increases. For example, aircraft engines take oxidizer from air and its specific impulse increases up to 3000. In general, if all propellant is taken from outside, I_{sp} could be infinite. Moreover, the maximal speed of a rocket is limited by volume of propellant stored in the rocket ($\Delta v = v_e \ln[(M + P) / P]$), but if all propellant is taken outside or delivered on the board in the time of flight, the achieved speed becomes unlimited.

There exist some paradoxes related to jet propulsion:

- Assume that a rocket is delivered to some point above ground. Then the rocket engine starts in such a way that the

thrust is equal to weight of the rocket. The engine works, but the rocket stays at the same point. Neither the potential energy nor the kinetic energy of the rocket is changing (potential energy even declines), but total energy spent on jet acceleration is not zero ($E = \frac{1}{2}MV^2$, where M is total mass of propellant, and V is jet velocity, and $V = I_{sp}g$ in any unit). So, the rocket engine spends its energy for nothing! The situation becomes understandable when it is proposed that the thrust is only a NON-COMPENSATED force. What is happened with the jet - nobody cares about. It does not affect the thrust chamber characteristics. If the jet is under-expanded, it stills expanding in free space (atmosphere) and you can see exhaust plume - glowing contour of nuzzle continuation following by the contour of pre-sonic part of thrust chamber; and it is repeated few times (shockwave patterns so-called 'Mach Barrels'). Moreover, one of rocket's launching losses is so-called 'gravitational losses' that are in effect only when the rocket engine operates.

- Also, it is known that one-stage rocket (unlike a projectile) can achieve speed exceeding speed of the jet. So, it looks like the rocket accelerates the jet, but, as was mentioned above, the jet does not have any relation to the thrust; and what is happened with the jet outside the engine does not affect the rocket.
- Another example is the engine with a 'thermal chamber' used in 60's, which is just a tube with supersonic nuzzle ($F_{ch}/F_{cr} = 1$). In such engines heating of gases provided by burning process accelerates gases up to sonic speed. The speed of the jet provided by such engines is the same as one provided by modern chambers having $F_{ch}/F_{cr} > 3$, but thrust is less because only the 'major' part of the thrust is provided by the pre-sonic part of the thrust chamber. This example additionally shows that the thrust is developed only by NON-COMPESATED force.

Therefore, the rocket thrust development and jet acceleration are completely different processes that are applied to different objects. It is even more obvious in electric rocket engines such as electromagnetic (electrodynamic) thrusters - Lorentz force thrusters.

3. Electrodynamic Thrusters

Electrodynamic (electromagnetic) thrusters have been known for decades [1, 4]. They are utilized in space platforms for acceleration and orbit stabilization. But even though their theory and design are well known and described in technical literature [1], [4], not all of its features have yet been analyzed. The topic of the present article is Lorentz-force thrusters that, it seems, can be transformed into supportless thrusters. Figure 1 represents the concept.

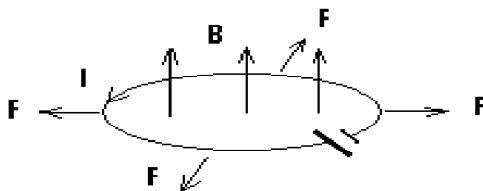


Figure 1. Supportless thruster.

We have a closed conductive loop (circuit) with running direct current. We can analyze forces applied to this single-loop circuit placed in external magnetic field.

The current running in the loop is determined by the formula:

$$I = U / (R_{ext} + R_{int}) \quad , \quad (3.1)$$

where R_{ext} - resistance of the loop, and R_{int} - internal resistance of the source (battery).

The Lorentz's (Ampere) force applied to element of the loop dl is determined by formula:

$$dF = BI \, dl \quad , \quad (3.2)$$

wherein $\mathbf{B} \perp d\mathbf{L}$. The loop is evenly stretched; all forces applied to the loop in radial direction compensate each other, so the loop does not move. If direction of the current is changed to opposite, the loop will be evenly compressed (in radial direction), but stills not moving.

In Fig. 2, part of the loop is cut.

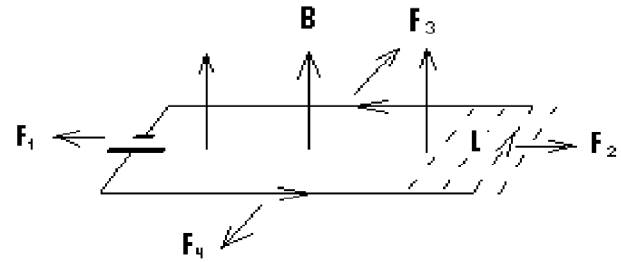


Figure 2. Fig. 1 with a cut.

Now the loop has a gap of length L . In this case resistance of the loop will be infinite, and the current will be zero.

Place the ends of the gap in a conductive substance (liquid, gas, etc.). Now the loop is electrically closed again, but by means of a conductive medium that is not mechanically connected to the loop. The current running in the loop is determined by the formula (2.1) $I = U / (R_{external} + R_{internal})$, where R_{ext} is the resistance of the loop including resistance of the gap that is now in the conductive substance.

It is obvious that forces F_3 and F_4 applied to side conductors compensate each other, but forces F_1 and F_2 , which are equal, are applied to different objects. Force F_1 is applied to the frontal conductor, whereas force F_2 is applied to conductive substance, which is not mechanically connected to the loop. Therefore, these forces do not compensate each other; and the force F_1 is applied to the loop, whereas F_2 simply accelerates this conductive substance. So, the loop starts accelerating in the direction of F_1 .

Forces F_1 and F_2 are approximately determined by formula:

$$F_1 = F_2 = BIL \quad , \quad (3.3)$$

where L is the length of the gap. So, the force F_1 pushing the loop is proportional to the gap width.

It looks like reactive propulsion and all electrodynamic rocket engines utilize this principle, but, if in the case of classic rocket engines gas inside of the thrust chamber is directly contacted with walls of the chamber providing pressure that produces the thrust, in this case it is no any mechanical contacts between the loop and the conductive substance. So, this substance can not push the loop; it needs only to electrically close the circuit; and only the NON-COMPESATED force F_1 can propel the loop. And, what is happened with this substance - stable it or moving in any direction - does not mechanically affect the loop, but the substance is accelerated and disappeared in the direction F_2 that is opposite to direction of the loop acceleration. This principle is, particularly, utilized in so-called 'rail guns' and Lorentz's plasma thrusters [1].

It is impossible to collect this substance and turn it back because its momentum will compensate impulse of force applied to the loop and the loop will be stopped. Therefore, the thrust is not developed with the jet; it is created by only NON-COMPESATED force, applied to the part of the loop. The same force is applied to the conductive substance producing the jet. So, it formally looks like reactive propulsion.

The similar forces are applied to linear and rotational homopolar motor (Fig. 3)

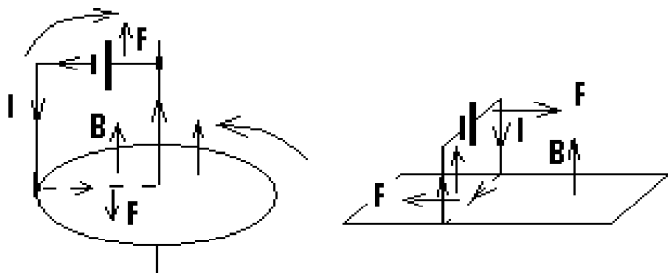


Figure 3. Homopolar motor.

In this case the conductive media that is not mechanically connected to the loop (conductive circuit) is a metallic strip or disk. Here, equal forces F are applied to the disk and the circuit in opposite directions. So, the disk rotates in one direction, whereas the circuit - in opposite one. If the circuit is held, the disk rotates and vice versa that has been experimentally proved.

Therefore, the conductive medium only electrically closes the loop creating conditions for running current ($r \neq \infty$), but only NON-COMPESATED force applied to part of the loop produces the thrust!

This principle is utilized in 'Electrodynamic Tether Propulsion' (program TSS), where a long conductive cable was released from Space Shuttle Columbia (STS 75). Moving in Earth's magnetosphere Tether develops high voltage because of Lorentz's induction. If ends of Tether are shortened by ionosphere conductivity, it starts operating as an electromagnetic engine, wherein the ionosphere plasma is not mechanically connected to Tether. In this case it develops braking force. If Tether is connected to any electrical source (solar battery, etc.) it will produce accelerating force.

4. Supportless Electrodynamic Thrusters

4.1 Thrusters Utilizing External Magnetic Field

As was mentioned above, the conductive media needs only for electrical closure of the circuit and only non-compensated electrodynamic force applied to the part of the circuit (loop) produce the thrust. In the case of direct current, such loop will be continuously accelerated in one direction. If the current is alternating one, the loop will be periodically moving back and forth (just shaken with the frequency of the current), but, in general, the loop doesn't move.

Despite this, alternating current has some adventure. In the particular, it can pass through vacuum via what is called 'electric displacement field' ('displacement current'), wherein vacuum is a polarizing dielectric (see Maxwell's equations) [5, 6]. This principle works in capacitors, antennas, etc.; and all radio technique is based on. So, the circuit shown on Fig. 4 with running AC current will be electrically closed, wherein the electrical source G is AC generator and C - is vacuum capacitor.

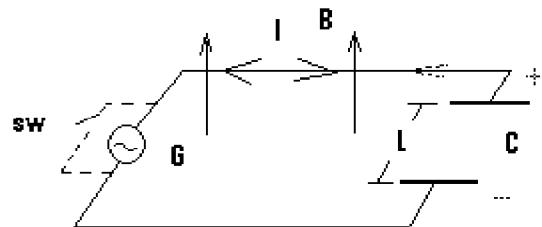


Figure 4. Similar circuit for AC only.

So, the loop shown on Fig. 4 will be just shaken back and forth, but it stills not moving.

Substitute generator G by switch SW .

Charge capacitor C to some voltage by DC battery (switch SW is open).

Now close switch CW . The capacitor is discharging and current is running in the circuit. The current develops impulse of force applied to the left conductor that will be proportional to the gap between capacitor's plates L . So, the circuit will move to left.

Charge the capacitor (DC battery instead of generator G). The capacitor is charging and current is running in the opposite direction. The current develops the same impulse of force applied to the left conductor, but in the opposite direction. So, if the capacitor is sequentially charging and discharging, the circuit shown on Fig. 4 will be just shaken back and forth, but it stills not moving.

Therefore, electrodynamic thrusters using non-alternating external magnetic field cannot operate, but if the external magnetic field is alternating simultaneously with AC current, such thruster can work. This approach is described below in part 4.2.

4.2 Thrusters Utilizing Internal Magnetic Field

In all mentioned above cases the circuit (loop) is placed in external magnetic field; and magnetic field developed by the circuit is negligible.

Remove now the external source of magnetic field (Fig. 5).

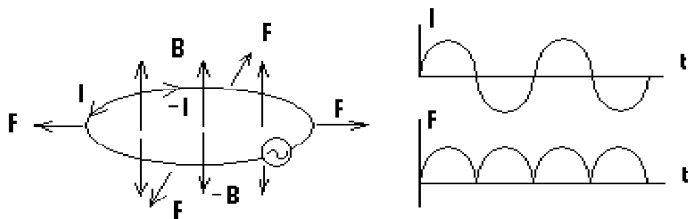


Figure 5. The system without the external magnetic field.

As was mentioned above, DC current running in the loop develops magnetic field that interacts with the current and stretches the loop regardless the current direction. If the current is AC, the loop is also stretched, but forces applied to the loop will be pulsing ones (as shown on Fig. 5) with double frequency because direction of the magnetic field developed by the loop (vector B) is alternating simultaneously with current direction. So, the loop (coil) with AC current is continuously stretched. The practice proves it. For example, it is known that a coil with very high pulse current used in experiments to develop very high magnetic induction is broken apart, even exploded under stretching forces.

Set now a vacuum capacitor in the circuit (Fig. 6).

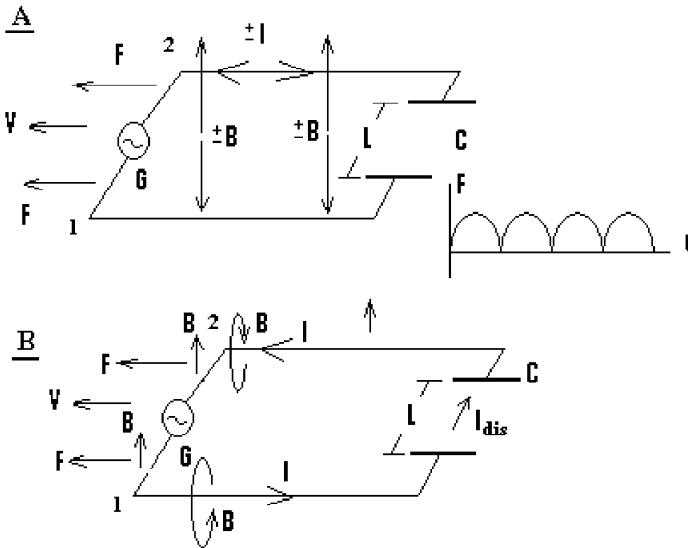


Figure 6. The system with a vacuum capacitor.

In this case, non-compensated force F proportional to the capacitor's gap L will be applied to the circuit in one direction in the same way as in the case, when the circuit is electrically closed by the conductive substance (see above), but here the function of conductive substance performs vacuum and this force is pulsing one (see Fig. 6).

It looks like jet propulsion, doesn't it? Electromagnetic thrusters described above formally produce a jet; but what produces the jet here, vacuum, or what? Does it mean that the capacitor accelerates vacuum or ether?

It is known that capacitor's conductivity is the result of running 'displacement current' [5], [6] that is real one producing magnetic field and retranslating electromagnetic wave. Also, it is known that vacuum is a polarizing dielectric, but what is polarized here? In pre-Einstein time scientists believed that this polarizing substance is ether; and Maxwell derived his equations using the model of the deformed electrically charged vortex (modern physics tries to forget it). Anyway, 'displacement currents' exist, and all electromagnetism is based on them.

Therefore, the circuit depicted in Fig. 6 will work as 'supportless' thruster that doesn't produce any jet (or produces jet of ether?) and doesn't spend any propellant, but the capacitor C has to be the vacuum one, because additional internal dielectric that is widely used in capacitors is mechanically connected to capacitor's plates; so forces applied to the dielectric will compensate ones applied to conductor 1 - 2 on Fig. 6. Analysis suggests that only part of force F (proportional to $\epsilon - 1$) will be compensated and F remains the same as for the vacuum capacitor without additional dielectric.

The force dF applied to element dL of the circuit is determined by the formula [5], [6]:

$$dF = I(B \times dL) \quad (4.2.1)$$

so force F applied to conductor AF can be approximately evaluated by the formula (3.3) $F = IBL$ ($B \perp L$), where the magnitude L is the width of the gap (see Fig. 6).

The magnetic induction B of the internal magnetic field developed by the circuit can be determined from the Biot-Savart law [5, 6], where, according to the principle of field superposition, all members of the circuit develop magnetic field applied to conductor AF (see Fig. 7). Current I depends on the voltage of the source and the resistance (impedance) of the circuit, which consists of active resistance of conductors and reactive resistance of the capacitor C ($X_c = 1 / 2\pi f C$, where f is current frequency).

The thrust developed by this thruster can be briefly evaluated (see Fig. 7).

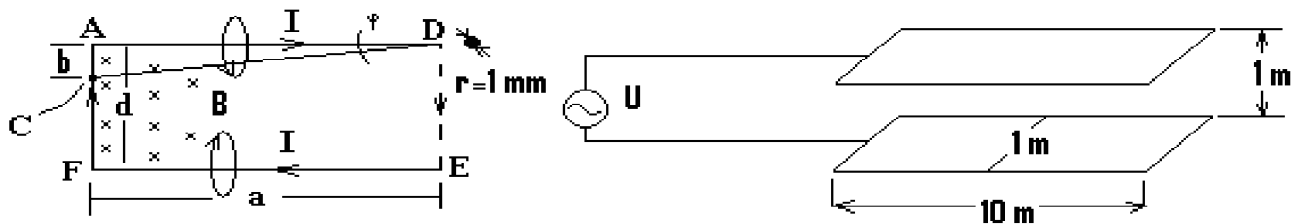


Figure 7. Schematic for evaluating thrust.

Assume that the vacuum capacitor has dimensions shown on Fig. 7. The approximate formula for the thrust follows from the Biot-Savart equation for rectangular circuit. The magnetic induction at the point C of conductor AF developed by single side conductor AD can be calculated by the formula from [6]:

$$B = \mu_0 I \cos \varphi / 4\pi b \Big|_{\varphi_2}^{\varphi_1} = (\mu_0 I / 4\pi b) (\cos \varphi_1 - \cos \varphi_2) \quad , \quad (4.2.2)$$

or, approximately,

$$B \approx \mu_0 I / 4\pi b \quad . \quad (4.2.3)$$

where $I = 2\pi fCU$ is the current running in the circuit. So force applied to element db of the conductor AF at the point C (here induction B is developed by conductor AD) is:

$$dF \approx (\mu_0 I^2 / 4\pi) db / b \quad . \quad (4.2.4)$$

and the total force applied to conductor AF (here induction \mathbf{B} is developed by both side conductors - AD and FE) will be:

$$F \approx (\mu_0 I^2 / 2\pi) \ln(b_2 / b_1) \quad . \quad (4.2.5)$$

It was proposed that magnetic field applied to conductor AF is created by the side conductors AD and FE (capacitor's gap is not taken into account, even though displacement current develops a magnetic field too).

Calculations show that the thrust developed by such thruster is about $F \approx 0.6 \times 10^{-4}$ N (0.06mN) at 10A current, or $F \approx 1.8 \times 10^{-4}$ N (about 0.02 gram) at 30A current. The capacitor shown on Fig. 7 has capacity of 200 pf; and, to develop current of 30A, it needs 6,000 V at 10 MHz frequency.

This calculation is very brief one, but it allows evaluate thrust that could be expected from such thruster. It shows that the characteristics of such thruster are close to ones of conventional electrodynamic thrusters.

4. Three Thrusters Utilizing Internal Magnetic Field and Bias

The thruster proposed here is the further development of the one described above, in which the thrust is significantly increased by means of bias. The scheme of such a thruster is shown on Fig. 8. The thruster contains a coil, one turn of which is cut in half and connected to capacitor C.

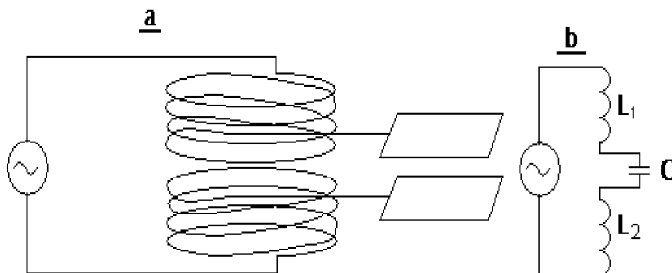


Figure 8. Scheme for exploiting bias.

The coil increases magnetic field applied to the turn in the number of winding (approximately). Also, if frequency of the source of current (generator) is equal to resonant frequency of this series circuit (coil L_1 plus L_2 , and capacitor C, see Fig. 8b), resistance of the circuit will be active and determined by active resistance of the coil and internal resistance of the source.

We can evaluate thrust of such a thruster. Assume that the coil has diameter of 1 meter and contains 1,000 turns of copper wire of 2 mm in diameter. One turn of the coil is cut in half and has a gap equal to coil's diameter, ends of which are connected to vacuum capacitor C (dimensions shown on Fig. 7).

In this case the non-compensated force is applied to half a turn regardless of the number of turns, whereas magnetic field is determined by the number of turns. So, thrust of this thruster will be approximately higher than the thrust developed by single loop in the number of turns.

Resonant frequency of this circuit will be about 11 MHz and active resistance of the coil will be about 60 Ohm. Because impedance of the circuit is active, the power dissipated in the circuit will be $P = I^2 R$, where R is the active resistance of the circuit.

Magnetic induction B is determined by Biot-Savart formula [5, 6]:

$$B \approx \frac{\mu_0 I}{4\pi r} \int_0^{\Psi} \frac{d\varphi}{\cos(\varphi/2)} \quad , \quad (4.3.1)$$

where I - current, r - radius of the loop, φ - central angle. The upper limit of the integral is $\Psi = \pi - \pi/500$ because $B \rightarrow \infty$ at $\Psi = \pi$.

After integrating the formula of induction B at any part of the loop will be as follows:

$$B \approx \frac{\mu_0 I}{4\pi r} \ln \left[\frac{\tan(\pi/2 - \pi/1000)}{\tan(\pi/4)} \right] \approx \frac{\mu_0 I}{4\pi r} \ln(318/1) \quad . \quad (4.3.2)$$

The force applied to half of the turn is determined by the formula: $F = 2B I r$; and for single loop it will be about $F \approx 1 \times 10^{-4}$ N at 10A current. So, for 1,000 turn coil, this force will be about 0.1 N (10 grams) at 10A current; and the power consumed by the thruster will be about 6 kW.

The same effect can be achieved by introducing additional coil in the scheme shown on Fig. 4 (part 3.1), wherein the external magnetic field developed by this coil is alternating simultaneously with AC current so providing bias to the circuit shown on Fig. 4.

And, again, this calculation is very brief - just for evaluation purposes to figure out characteristics that can be expected from such thrusters.

The power that needs to feed the thruster can be produced by solar panels of space apparatus; and it looks like that the thrust of such thruster is similar to one of conventional electromagnetic thruster. Also, the thrust is proportional to consumed power in accordance with conservation law; and all electromagnetic thrusters including ones described in the present article require an energy source (such as solar panel, nuclear reactor, isotopic generator, etc.).

5. The Photonic Propulsion Engine – a Genuine Supportless Thruster

Assume that we have light bulb evenly radiating in all directions (Fig. 9).

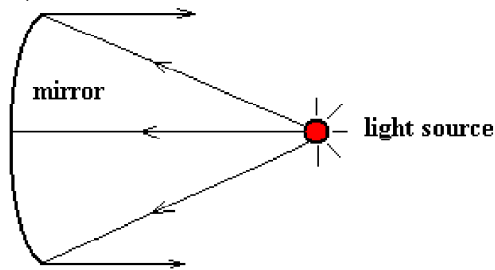


Figure 9. Optical arrangement.

According to any physical model (photonic or electrodynamic) the bulb is in balance, because all forces applied to such bulb are compensated.

Part of radiation is captured and reflected by a mirror so producing thrust, wherein both, electrodynamic and photon theories can be used for explanation of this phenomenon.

According to the photon theory [1], photons – charge-less and mass-less particles – don't produce any jet; the bulb doesn't spend any mass, so 'photonic engine' is the supportless thruster.

Here, it needs to be remembered that, in the early days of photon theory, it proclaims photon as a particle having so-called 'relativistic mass'. Such definition has been changed for many reasons, particularly, because the 'mass' of the photon directly contradicts with energy-mass transformation. So, if photon has mass, in the case of electron-positron annihilation the mass of this couple is directly transformed into the mass of two photons,

not in clear energy. And, seems that photon is not a particle at all; it is just quant – a portion of electromagnetic wave. In 60x there was introduced so-called 'phonon' – a quasi-particle of acoustic wave, wherein photon and 'phonon' interact as real particles in acousto-optics. So, seems that photon is quasiparticle too (this is important, but separate matter, that is not directly related to the topic of the present article).

According to the electrodynamic model of interaction between conductive surface and electromagnetic wave, vector \mathbf{E} – electrical field of electromagnetic wave – induces current I in element Δl of the conductive surface (it is a 'displacement current' in the case of dielectric surface); and vector \mathbf{B} – magnetic field of electromagnetic wave – interacts with Δl pushing it forward with force \mathbf{F} . Because phases of \mathbf{E} and \mathbf{B} are changing simultaneously, the direction of \mathbf{F} stills the same, which is in coincidence with Poynting vector \mathbf{S} , wherein force \mathbf{F} is pulsing with double frequency of electromagnetic wave. Here, absence of any jet is obvious. Therefore, photonic propulsion engine is the genuine supportless thruster.

There are other supportless thrusters related to the mentioned photonic propulsion, such as radio antennas with asymmetric directional pattern; for example, dish antenna with dipole excitation (Fig. 10)

It is obvious that the dish antenna depicted in Fig. 10 works exactly like photonic propulsion engine, where electromagnetic wave is produced by the dipole instead of the light bulb. The dipole itself doesn't produce any thrust because its directional pattern is symmetrical.

Also, such antennas as waveguide and horn antennas [7] also provide 'photonic' thrust (Fig. 11).

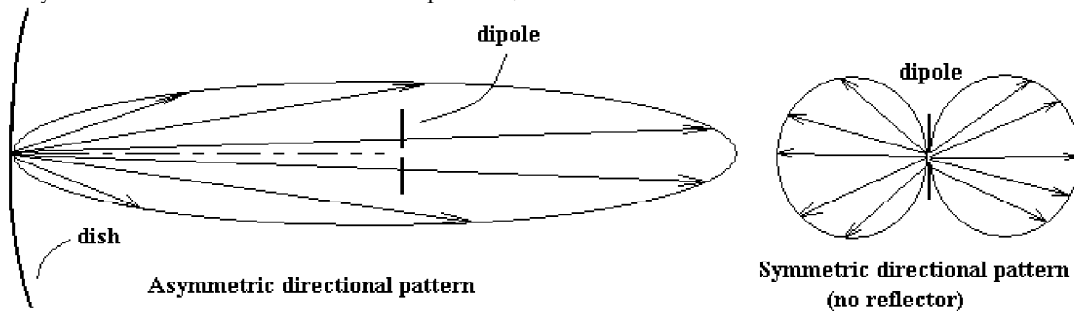


Figure 10. Radio dish arrangement.

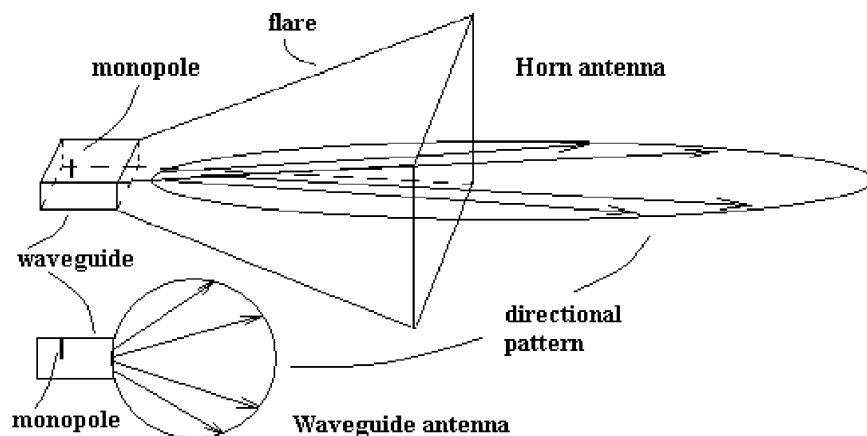


Figure 11. Horn antenna arrangement.

Here, electromagnetic wave, reflected from the end of the waveguide (and from walls of the flare), provides the thrust that is very similar to one provided by a 'photonic thruster'.

So, it is obvious that any antenna or antenna array with ASYMMETRIC directional pattern produces 'photonic' thrust; and sharpness of the pattern (antenna's gain) together with power of RF generator are responsible for the thrust value.

We can evaluate the thrust developed by such thrusters. Pressure developed by electromagnetic wave can be determined by the formula [5, 6]

$$p = (W / C)(1 + R) \quad , \quad (5.1)$$

where p is light pressure (N/m), W is power of radiation per square unit (W/m), C is speed of light (m/sec), R is reflectivity ($R = 0$ for a black screen and $R = 1$ for an ideal mirror).

For 10-kW power applied to the reflector, it will be about 0.6×10^{-4} N (0.06 mN) of the thrust regardless the reflector dimensions. Also, this thrust is the same that is developed by the supportless electrodynamic thruster described above in part 3.2 that contains single loop. It shows relation between photonic thrusters and the supportless electrodynamic thrusters – the object of the present article.

4. Conclusion

Many cases of reactive propulsion, which are classical examples proving Newton's First and Third Laws are just a simulation (appearance) of reactive movement. In these cases the thrust is developed from non-compensated forces, applied to walls of a rocket engine, or to an electrical circuit. Especially, it is obvious in the case of 'photonic' and electrodynamic thrusters, in which a conductive media needs only to close a circuit. The electrody-

amic AC thrusters utilizing a vacuum capacitor described in the present article can be counted as supportless thrusters, wherein the capacitor is used only to close the circuit via displacement current. As calculations show the characteristics of such thrusters are close to ones of conventional electrodynamic thrusters. Also, any RF antennas (fed by RF generator) that has asymmetric directional pattern can work as a supportless thruster, wherein power of the generator and sharpness of the directional pattern (antenna's gain) effect the thrust provided by such apparatus. Moreover, it seems that photonic and supportless electrodynamic thrusters are based on the same principle.

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Philosophizing about Natural Philosophy

Continued from page 2

Newton referred to a hypothesis of *continuous* absorption of aether in matter, hypothesis physics can not assimilate, yet the mathematical formalism he develops fit the reality. Similarly Einstein imposes, via his *principle of absolute constancy of c*, this meaning that the propagation speed of electromagnetic waves in void, should be a *physical entity absolutely constant*; a supposition he validates by the logic developed in his SRT. *Incidentally*, the so resulting formulae appear identical to the Fitzgerald-Lorentz formulae; in fact with the Lorentz-Poincaré coordinate transformation *which are, by intent and definition, conditioned to transform identically Maxwell's equations between two inertial moving reference systems*.

Yet 'incidentally' is not the adequate term to characterize the process; in fact it should be "*naturally*" because, Einstein as well as Lorentz-Poincaré, imposing a same conditioning -- specifically: the *independence of c from the inertial reference system effectively adopted*, it is only normal that they shall obtain identically formalized answers yet with profoundly different physical meanings.

Therefore one may wonder: why is there so much argument about the SRT's true meaning? Apparently, it is because one forgot that the notion of speed of light in void, if *abstractly defined as physical item*, profoundly differs in meaning from the notion '*measure*' of the speed of light in void; the first is an abstraction while the second is *instrumental* in the sense I.E. Ives so much insisted on [4], [5]. This confusion happened and was lengthily maintained due to a difference in interpreting the notional definition: Poincaré and Lorentz in their demonstration focused, specifically, on the *measured value* of c , while Einstein focused on the *phenomenological item itself*. The proof of this last statement comes out clearly from the known fact that Poincaré and Lorentz were looking for a particular set of inertial space-time systems of coordinates able to ensure that Maxwell's equations would take the same form in the whole transform-group so conditioned, while Einstein endeavored to force his constant speed of light principle, associated with his own definition of simultaneity, to fit with the light propagation *phenomenon itself*. Of course, both procedures deliver the same set of equations, namely the well known Lorentz's formulae. Yet, in spite of the fact that Albert Einstein is, as well as his followers, convinced that the STR way in which himself deduced Lorentz's formulae have the same meaning as the

Lorentz-Poincaré ones, considered in their depths their true meaning appear *totally different*. In the Lorentz-Poincaré case the coordinate transformation is *similar* in significance with the transformation from blueprint-drawing mode to in perspective representation. In Einstein's interpretation the Lorentz group has, forcibly, *physical* explanatory power. In reality it has that power not by the force of Einstein's principle << *c*, by definition, equal to a constant >>, yet as a consequence of a real, physical and instrumental constancy of *c* by power of two *physically real phenomena* (by the way, both by Maxwell's theory deducible):

- the FitzGerald-Lorentz length contraction phenomenon,
- the Ives-Stilwell electromagnetic oscillators' slowing down.

This kind of SRT was essentially understood and documented, many tens of years ago, by at least one researcher; namely H.P. Robertson [6].

SRT in this way assumed would state that **all** electromagnetic phenomena not only *show* themselves running the same, whatever the inertial reference-frame adopted, yet *factually run identically* in all inertial systems.

The above interpretation leads to a fundamental conclusion: Einstein's principle "*all inertial systems are equal in expressing nature's laws*" becomes, if so reinterpreted, a **theorem** intuitive means demonstrated.

Concluding, one may wonder if Einstein did not, by his permanent refusal to accept the existence of a substantial aether, determined the difficulties he complained of while working on

his GTR. If simply renouncing to maintain into his GTR the SRT's spirit of *absolute constancy of c* he would not have got rid of these difficulties. If, assimilating into his GRT -- a magnificent piece of mathematized physics -- the constancy of *c* not as an abstract mathematical constant, but as simple constancy of the light's propagation speed *relative to an ambient aether*, he would not have succeed too round up, as he sometime expressed the hope, his GRT.

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Restoring 'Ether' to Model the Magnetic Field

After deep, long, and repeated study, the authors consider that 'ether' must exist in the Universe. The following argument assumes the existence of 'ether', and makes a further step in supposing that 'ether' is a kind of elastic material in the shape of a crystal that is formed of electrons and positrons. This ether model implies a model of magnetic field that corresponds to the existing electro-magnetics, so that many phenomena, and some theories in electro-magnetics, can be explained thoroughly.

1. Introduction

I have been studying 'ether' for 30 years, and firmly believe that 'ether' exists. This is my thesis: The original algorithm used in the Michelson-Morley Experiment is wrong, and the Constancy Principle has always been unfounded. This idea had been published in Florentin Smarandache's book [1] Smarandache argued that the non-existence of 'ether wind' cannot be proved with Michelson's experiment, because its calculation method is false. In other words, its principle is false. This view had been recognized by many persons; for example, Shi Tianzhi's article [2] His standpoint is almost identical to mine. Su Zhonglin's article [3] His standpoint and content is similar to mine, although not identical. It is my thesis [4] that had explained that the hypothesis 'ether' must be renewed. A friend, an insider from Beijing Relativity Study Society?" gave a letter to me, where he said: "Your thesis has insight, is very deep and good, will obtain a remarkable achievement soon."

In all, through the careful research, I conclude that there must be 'ether' in the universe. But what is 'ether' on Earth? From

modern physical research results, it is known that a photon that has wavelength of one Angstrom ($1 \text{ \AA} \gamma$ gamma ray) can convert to an electron - positron pair. Contrarily, when a positron and electron meet, they can both disappear and there appears a γ photon. And this clearly shows 'ether' existing in the Universe is a kind of elastic crystalline lens material made up of positrons and electrons. Of course, we can make a further study of the configuration of 'ether' crystal according to the theories of material configuration and other knowledge [8-10].

2. Many Scholars Believe that 'Ether' Exists

There is a saying by Huang Xinwei [11]: "Why do we want to revive the concept 'ether'? The speed of material particle is variable, why the speed of light is invariable?" My own viewpoint is: in order to explain the speed of light is invariable in an inertial reference frame, we must fill the vacuum of the inertial reference frame with a certain matter, otherwise, which cannot be justified. Even if someone dislikes the term 'ether', in order to fill the vacuum, we have no choice but to introduce 'field', and so on, which are something have a change in form but not in essence, even if anything would be introduced to fill the vacuum, but it has been admitted that the Earth can drag partially a surrounding vacuum to influence the speed of light in which, no other than can explain a new optical phenomenon. In this circumstance, it would be better to restore 'ether', present it with a new characteristic. For example, in the sake of explanation of photoemission, we must consider the properties of a particle of light.

In America, Prof. Ruyong Wang says that the complexity of the 'ether' may exceed our imagination. [12]

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Resolving Paradoxes of Homopolar Machines

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Features of homopolar generators and motors are investigated here, and this investigation allows a proposal that the magnetic field is a stationary deformation of aether structure that does not move together with the source of the magnetic field.

1. Introduction

Homopolar generators are known for many years starting from the mid of XIX century, when the first such generator had been invented by Faraday; but until now there are lots of controversial meaning about its operation, wherein some of researchers proposed them as 'generators of free energy'. The author of the present article has been conducting deep research on homopolar generators and motors, their features and operational principles. This research allows not only clarifying operational principles of such machines, but also proposing very fundamental principle according to which the magnetic field is not a 'form of matter' - it is rather a stationary deformation of very specific part of the aether that is responsible for all electromagnetic interactions.

2. Equivalent Contours of Permanent Magnets

The matter of this paragraph is not directly related to the homopolar induction and force, but it can be useful to understand the subject of the present article; in particular, because all experimental models of homopolar machines discussed in this research use permanent magnets as the source of magnetic field.

It is known that the total magnetic moment of permanent magnet is sum of magnetic moments of nucleus and electrons, electron's orbits, etc.

$$p = \sum_i p_i \quad (2.1)$$

Therefore, these moments can be substituted by an equivalent circuit of running current, of which the magnetic moment is equal to this sum. Experiments conducted by the author of the present article [1] show that this circuit (it can be one or two for different magnet configuration) is responsible for magnetic field structure; moreover, this circuit interacts with other circuits and conductor with running current according to Ampere Law, so it works as the real circuit. Position of the circuit on the surface of permanent magnet can be found experimentally by means of thin wire with current placed near the magnet.

Experiments reveal that these circuits are positioned on the surface of a magnet (not in the body); and number of such circuit for simple-configured magnets (disc, ring, drum, etc.) can be one or two, not more. For example, axially polarized disk magnet has the single circuit surrounding the magnet in the middle of its cylindrical surface. An axially polarized ring magnet has two circuits surrounding the magnet in the middle of its internal and external cylindrical surfaces, wherein currents running in these circuits have opposite directions (Fig. 1).

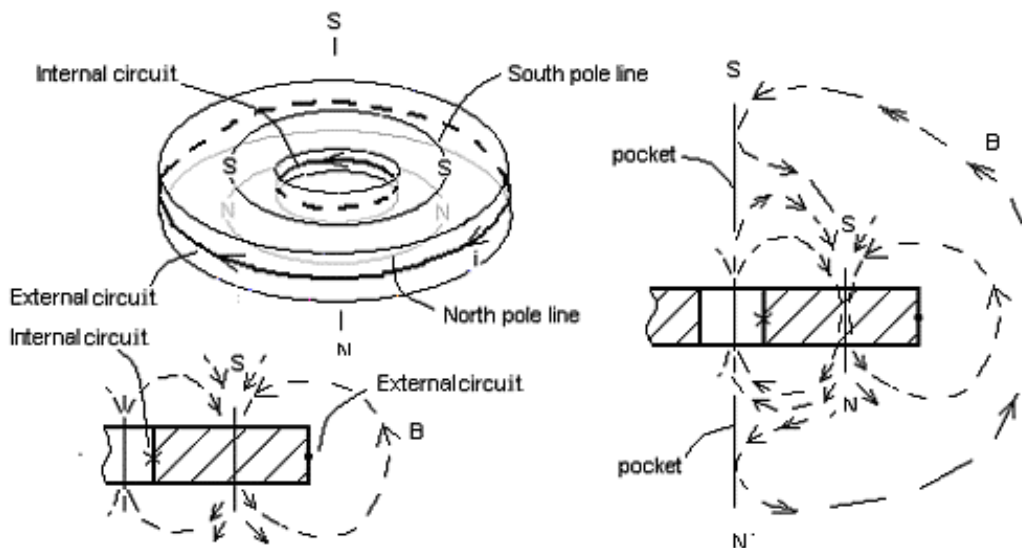


Figure 1. Axially polarized ring magnet.

Also, a radially polarized drum magnet (cylinder with axial hole) has two circular circuits with opposite current that are situated on the middle of its upper and lower ring surfaces (Fig. 2).

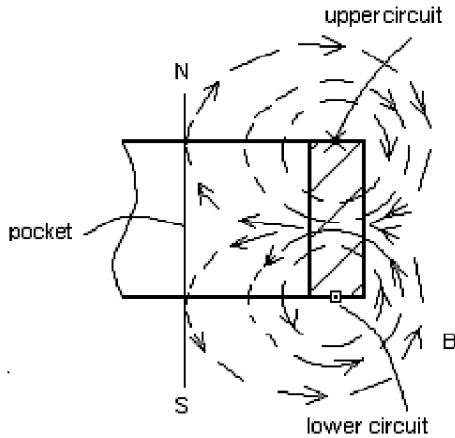


Figure 2. Radially polarized drum magnet.

An axially polarized short cylindrical magnet has single circuit in the middle of its cylindrical surface, etc.

Calculation shows that 'equivalent currents' running in these 'equivalent circuits' can reach 10,000 A. Also, some of these magnets have 'pockets' (Fig. 1), (Fig. 2) in which another magnet can levitate in axial direction (radial direction is not stable).

These configurations of the circuits and features of permanent magnets have been experimentally investigated by the author of the present article [1]; and they are the reality.

3. Homopolar Generators

As was mentioned above, the first homopolar generator was invented by Michael Faraday in the mid of XIX century (Faraday Disc). Modern homopolar generators [2] are utilized in electromachines producing very high current with low voltage.

The homopolar generator used by the author of the present article in the experiments [1] contain freely rotating axially-polarized 65x20x10-mm ring magnet (NdFeB) having homogeneous magnetic field and conductive disk placed in proximity with ring surface of the magnet that can freely rotate about the same axis independently from the magnet (Fig. 3).

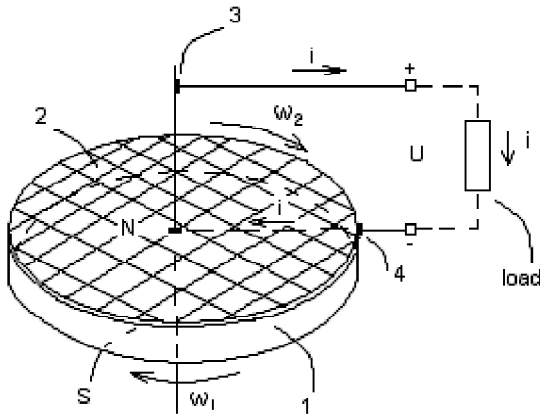


Figure 3. Homopolar generator used by this author.

Some variants of the generator in which disc and magnet rotate independently or together were tested. The experiments

showed that the homopolar generator has the following features, some of which are paradoxical [1], [8]:

- The magnet rotates with any speed in any direction, conductive disc does not. $E = 0$ (no induction).
- The disc rotates with angular speed ω , magnet does not. $E = U$ (operates as a generator)
- The disc and magnet rotate together with angular speed ω (the disc is fastened on the magnet's surface). $E = U$.
- Disc rotates with speed ω and magnet rotates in any direction with any speed. $E = U$.

So, to develop EMF the disc has to rotate. The magnet can rotate in any direction or does not rotate at all; it does not affect EMF developed by such generator that depends only on speed of the disc. The generator does not develop any EMF if the disc does not rotate, even though the magnet rotates.

These features are paradoxical, so they require explanation.

It is obvious that EMF of homopolar generator is developed by Lorentz's force applied to a charge [3]:

$$\mathbf{F}_l = q(\mathbf{V} \times \mathbf{B}) \quad (3.1)$$

Total force applied to the charge is sum of Coulomb's (static) and Lorentz's (dynamic) forces; it is determined by formula:

$$\mathbf{F} = \mathbf{F}_q + \mathbf{F}_l = q\mathbf{E} + q(\mathbf{V} \times \mathbf{B}) \quad (3.2)$$

In some papers this formula is known as the 'Lorentz force formula' [3].

Thus, current running in Lorentz's generators, when they are not loaded, is zero, total force applied to the charge is zero too ($\mathbf{F} = 0$); so Coulomb's and Lorentz's forces are in equilibrium ($\mathbf{F}_q = -\mathbf{F}_l$). It means that dynamic force \mathbf{F}_l separates charges until it is compensated by Coulomb's force \mathbf{F}_q . Therefore:

$$q\mathbf{E} = -q(\mathbf{V} \times \mathbf{B}) \quad , \quad \text{so } \mathbf{E} = -(\mathbf{V} \times \mathbf{B}) \quad .$$

Because voltage induced in conductor dl is

$$dU = \mathbf{E} dl \quad , \quad dU = V B dl \quad . \quad (3.3)$$

In many papers and textbooks formula (3.3) is derived from wrong artificial physical model - some expandable circuit, wherein one member of the circuit is moving with speed of V so enlarging surface of the circuit. In this derivation Faraday's formula ($U = -d\Phi / dt$) is used, even though EMF is developed by Lorentz's induction. In some cases such derivation allows Maxwell's equations formally explain Lorentz's induction, where the first equation in Faraday's form determines both - Faraday's and Lorentz's inductions; but, in particular, this approach has obvious disadvantage - it can not find out EMF induced in single member developed by Lorentz's induction. Additionally, it can be proposed that Faraday's induction appears only in the case of magnetic field variation - when $dB / dt \neq 0$.

Thus, voltage developed by the disc generator between axis and edge of the disc can be derived from the formula (3.3):

$$dU = B(r) \omega r dr \quad , \quad (3.4)$$

where ω is the angular speed of the disc.

If magnetic field of the disc surface is uniform ($B = \text{const.}$)

$$U = B\omega \int_0^R r dr = \frac{1}{2} B\omega R^2 \quad , \quad (3.5)$$

where R is the radius of the disc.

Therefore, the disk works as a set of radial conductors crossing lines of magnetic induction.

This could be a reasonable explanation, but the generator develops EMF in the case when the disc is directly attached to magnet's surface and rotates together with the magnet. If magnetic field moves together with the magnet, the conductors do not cross the lines and EMF has to be zero, because in this case relative disc-magnet speed is zero.

Also, experiments show that magnet rotation does not induce any EMF in non-moving disc despite of possible rotation of the lines of induction together with the magnet.

There are at least two hypotheses that could explain this paradox:

1) The first Hypothesis proposes that magnetic field rotates (moves) together with a source of magnetic field (a permanent magnet) [4, 5] and absence of EMF in the case when the magnet rotates, whereas the disc does not, is the result of compensation of EMF developed in the disc and in the external circuit. It can be illustrated as follows (Fig. 4):

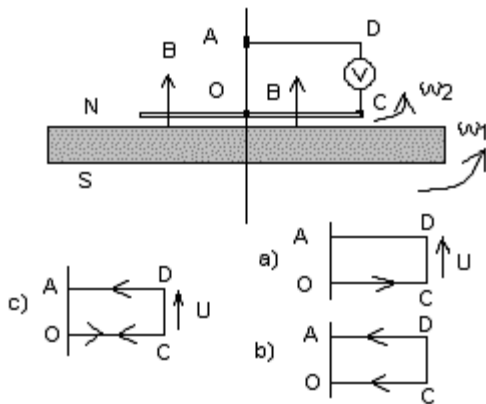


Figure 4. Illustration for the First Hypothesis.

- In the case **a** (the disc rotates, magnet does not) EMF is induced in the disc (conductor OC) and does not induced in external conductor AD (magnet field does not move).
- In the case **b** (magnet rotates, disc does not) the equal, but oppositely directed EMF is induced in conductors OC and AD, so total EMF is zero.
- In the case **c** (magnet and disc rotate) EMF is induced in the external conductor AD, whereas EMF induced in the disc (conductor OC) is depend on relative speed disc-magnet, and in the case when the disc rotates together with the magnet, EMF induced in OC is zero.

2) The second hypothesis proposes that the magnetic field is a stationary one that does not rotate (move) together with the source of the magnetic field (magnet) [1]. In this case, magnet rotation does not affect EMF, because the field and the lines of induction still not moving; so EMF only depends on speed of the disc. According to this explanation, EMF is induced in the disc (conductor OC) only (if external circuit is not moving).

Therefore, there are two equal explanations of this phenomenon; and experiments with homopolar generator can not clearly solve this problem.

3.1 Some Additional Observations About Homopolar Generators

There are some aspects of homopolar induction (Fig. 5) that have to be taken into account.

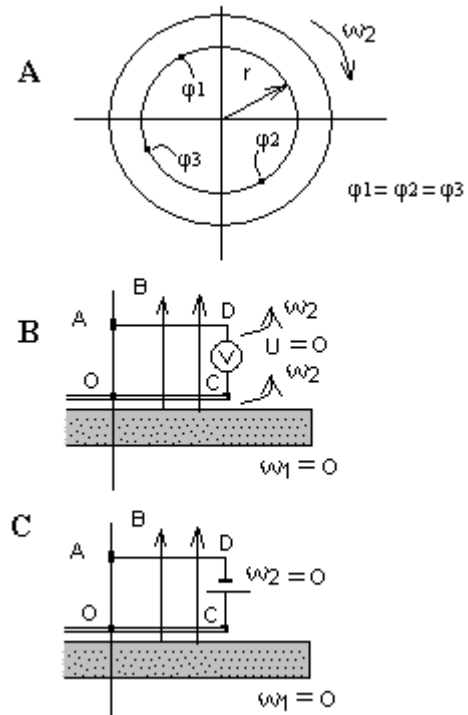


Figure 5. Aspects of homopolar induction.

- There are no 'eddy currents' on the disc of homopolar generator because electric potentials of disc's points situated on equal radial distances are equal. Therefore, EMF induced in members of any closed circuit placed on the disc compensates each other; and the total EMF is zero (Fig. 5A).
- Voltmeter placed on the disc to measure voltage between axis and disc's edge will show zero because EMF induced in voltmeter's connectors completely compensates EMF induced in the disc (Fig. 5B).
- Power source placed on the disc can not produce torque because forces applied to the disc and to the power source connecting wires will completely compensate each other (Fig. 5C).

These aspects are directly derived from features of homopolar induction and force. They look like understandable and ordinary ones, but sometimes they become confusable. For example, there is meaning that is no voltage developed in high steel tower;

and it is sometimes used as the proof of rotation of Earth's magnetic field together with Earth. In the fact, a voltmeter measuring such voltage will show zero because such voltage will be compensated by EMF induced in voltmeter's connectors (see above).

The mentioned features of homopolar induction do not allow creating a multi-turn homopolar generator; and the maximum that can be achieved is two-disc generator (Fig. 6).

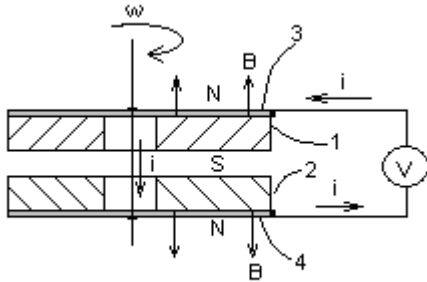


Figure 6. A two disc homopolar the generator.

Also, the two-disc homopolar generator was invented by N. Tesla [6], wherein two similar, but opposite polarized magnet with conductive discs were jointed like pulley by metallic belt.

3.2 Homopolar Generator and 'Free Energy'

Today it is believed that homopolar generators could be a source of 'free energy'. Particularly, some authors claim that efficiency of homopolar generators can exceed 100%. Consider the energy balance for such generator. Propose that element of conductor ΔL moves in uniform magnetic field ($\Delta L \perp B \perp V$, $B = \text{const}$) as shown on Fig. 7.

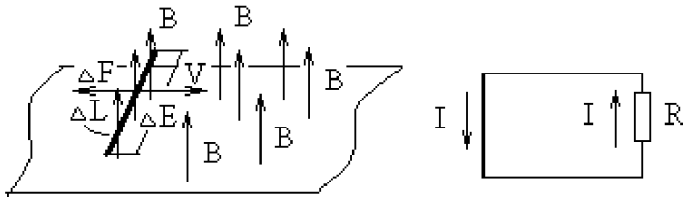


Figure 7. No free energy!

The EMF induced in conductor ΔL can be determined with formula (3.3): $dU = VBdl$, so the current running in conductor ΔL connected to load R will be $I = \Delta U / R$. This current interacts with the magnetic field so producing force of resistance $\Delta F = BI\Delta L$ directed oppositely to vector velocity \mathbf{V} . So:

$$B\Delta L = \frac{\Delta F}{I}, \Delta U = \frac{V}{I} \Delta F = VR \frac{\Delta F}{\Delta U}, \text{ and } V\Delta F = \frac{\Delta U^2}{R} .$$

This means that $M_{\text{mech}} \equiv M_{\text{el}}$ - electric power developed by the generator is identically equal to mechanical power retarding conductor ΔL . **Therefore, Lorentz's electro-machines, such as homopolar generators, cannot be 'a source of free energy';** it is also in agreement with the 'energy conservation law'.

This identity is understandable, because both, Lorentz's induction and force, are produced by the same mechanism - Lorentz's force, unlike Faraday's generators, in which EMF is developed by Faraday's induction, whereas braking force is developed by Lorentz's force.

5. Homopolar Motor - Proof of a 'Stationary Magnetic Field'

A homopolar motor is the inverted homopolar generator [7]. The homopolar motor used in the experiments conducted by the author of the present article has the design similar to one of the homopolar generator described above, but here DC voltage is applied to the disc; so current is running in the disc (conductor OC) and in the external circuit OADC connected to disc's edge by brush and to disc's axis by copper wire that transmits current to disc's center (see Fig. 3, 4). This copper wire was also used as a torsion that allows the disc turning under applied torque. In the experiments, in which the disc is directly attached to magnet surface, the magnet (NdFeB) was nickel-plated one; and this nickel coating was used as the conductive disc. The similar homopolar motors containing rotor only - nickel-plated NdFeB disk magnet - has been developed and demonstrated by amateur enthusiastic people [8]. Here, because of very-low-friction magnetic bearing used in its design, the motor fed by 1.5-VDC battery achieves speed exciding 20,000 rpm.

It is obvious that the torque of such motor is developed by Lorentz's force described by formula (3.1); so torque T applied to the disc can be derived from this formula:

$$d\tau = rdF = B_{(r)}Ird r \quad . \quad (5.1)$$

When the magnetic field is uniform ($B = \text{const}$), formula describing the torque applied to the disc will be as follows:

$$T = BI \int_0^R r dr = \frac{1}{2} BIR^2 \quad , \quad (5.2)$$

where R is the radius of the disc.

The experiments reveal that the motor start rotating (produces torque) exactly in the same cases, when the homopolar generator develops EMF:

- 1) The magnet is being held, the disc can rotate. **Disc rotates,**
- 2) The disc is fixed on the magnet and can rotate. **Disc rotates together with the magnet,**
- 3) The disk is being held, the magnet can rotate. **The magnet does not rotate.**

As in the case of homopolar generator, the first case is understandable and can be explained by both hypotheses (moving or stationary magnet field). There the disc is a set of radial conductors rotating in stationary magnet field in accordance with Ampere Law (magnet does not move).

The second and third cases require additional explanation (Fig. 8).

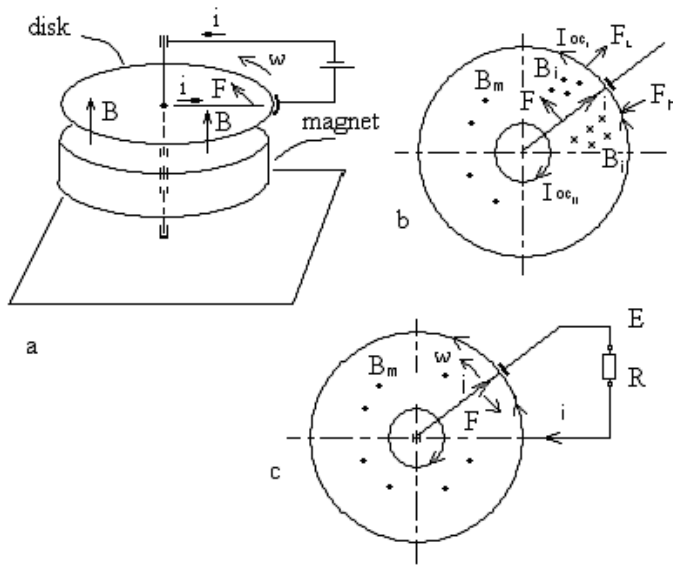


Figure 8. For additional explanation.

In the third case (when the disc is being held) magnetic field created by current i running in radial conductor OC interacts with magnet's 'equivalent circuit' producing forces F_l and F_r , but the currents running in these circuits are in perpendicular to each other; so mechanical force applied to these conductors (vectors of forces F_l and F_r) are directed to the center of the disc so not producing any torque; and the magnet does not rotate (Fig. 8b). Therefore, in the third case forces F_l and F_r do not develop any torque and the disc stills not rotating, whereas in the first case (Fig. 8a) force F created by interaction of current i and powerful magnetic field is applied to the radial conductor OC in tangential direction so producing torque and rotating the disc.

Also, in the second case (when the disc mechanically connected to the magnet) the disc pulls the magnet so they rotate together. This case, unlike similar case of generator, cannot be explained by 'compensation'. According to hypothesis of 'magnetic field moving together with a magnet', force, which rotates disc, cannot exist because there is no any relative disc-magnet movement, and all forces have to be applied to external conductors, but the external circuit is being held and electrically connected to the disc via brushes, which can not push the disc (they can only brake it because of friction). **Therefore, the hypothesis of 'magnetic field moving together with a magnet' is not valid; and only the hypotheses of stationary magnetic field can explain all features of homopolar machines. The case of homopolar motor when disc and magnet rotate together is the direct proof of the hypotheses of stationary magnetic field.**

This hypothesis also properly explains features of other devices utilizing interaction of homogeneous magnetic field, such as magnetic bearings [9], magnetic levitation devices, etc.

5.3 Additional Evidence of a 'Stationary Magnetic Field'

Some devices, such as magnetic bearings [9], etc., already used the features of a 'stationary magnetic field', wherein friction between sources of uniform magnetic field is absent.

There are additional experiments that support this hypothesis. An axially polarized permanent ring magnet is mechanically connected to axis of electric motor. A needle is being held by a thread in such a way, in which tip of the needle attracted by the magnet does not touch the magnet surface (Fig. 9).

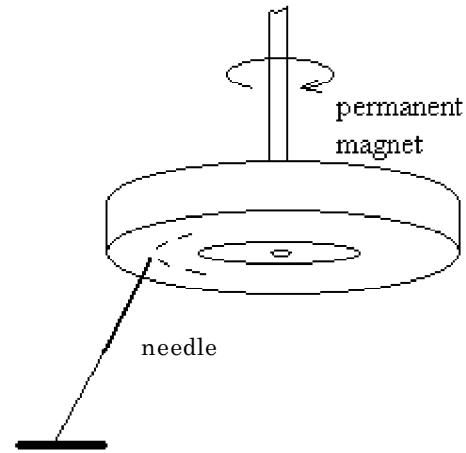


Figure 9. Another experiment.

Start rotating the ring magnet. You can see that the needle remains in the same position despite of magnet rotation. You can invert rotation direction, increase speed of rotation, but position of needle's tip does not change at all.

Two axially polarized permanent magnets with uniform magnetic field independently rotate about single axis (Fig. 10).

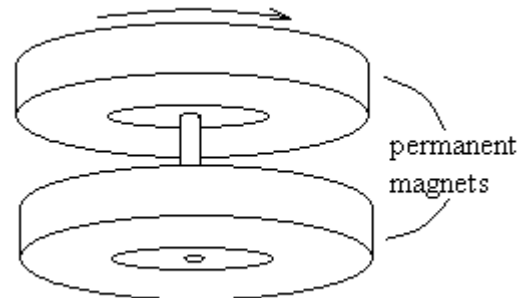


Figure 10. Two magnets rotating.

If one of magnets rotates, another one does not react and stills not moving regardless direction of rotation and speed of the first magnet. **So, it is no momentum exchanging between sources of uniform magnetic field.** Particularly, this phenomenon is utilized in magnetic bearings [9].

Moreover, it is impossible to detect by any measurements the movement of a source of uniform magnetic field.

6. Magnetic Field as a Stationary Deformation of 'Fine Structure of Aether'

All mentioned above experimental results and its analyses are direct proof of hypothesis of 'stationary magnetic field'.

Therefore, movement of an infinite source of uniform magnetic field (or rotation of source of uniform field) does not take effect in any coordinate system; it is impossible to be detected

by any measurements. The source can move (rotate), but the field stills stationary.

In the case of movement of non-stationary field, it induces Faraday EMF, but the field stills not moving; and its 'movement' is the effect of 'running lights', which are simply switched sequentially along the line. Also, it could be proposed that magnetic field is not a 'form of matter', it does not belong to a source of magnetic field; it is not a material object, but rather is **reversible dynamic deformation of some material substance – a fraction of aether**, its 'fine structure'. This substance is one of basic element of Universe; its structure stills absolutely unknown, particularly because of domination of relativistic dogmas prohibiting any research in this direction.

Analogously it can be proposed that electrical field is **static deformation of the same substance**. This substance is responsible for majority of energy storage and transformation in Universe (except gravitational one). Because all particles (except neutrino and quasi-particle 'photon') have charge, this substance directly participates on all levels in all energy processes including atomic and nuclear transformations; so size of the substance's element (if it exists) could be in many orders less than size of particles. Thus, this substance could be called 'fine structure of aether' or 'dark energy'.

6.1 Briefly About Aether Structure

As the development of ideas described above, author of the present article can propose that **aether** contains at least two substances [10], wherein the first one – the 'dark energy' is briefly described above, whereas **another one – 'luminiferous aether' – is another part of aether that is directly responsible for electromagnetic wave propagation, so 'retranslating' the wave** [10]. The most obvious candidates for such 'retranslating' are annihilated electron-positron couples, which being polarized by electrical field of electromagnetic wave retranslate the wave. Charge, spin, and magnetic moment of these particles are completely compensated; and they still keeping only mass, which cannot be directly detected. The conventional philosophy of energy-matter transformation seems incorrect for many reasons [10], so the pair still keeps its mass. Thus, after annihilation the couple is going in 'shadow' and becomes a part of so-called 'dark matter', but it can be polarized (vacuum is a polarized dielectric), or even taken apart by high electrical field ('pair production'). The substance

proposed above ('dark energy') does not by itself retranslate electromagnetic wave, but is directly participating in this process.

7. Conclusion

Author of the present article has been conducting deep research of homopolar generators and motors, its features and operational principles. This research allows not only clarifying operational principles of such machines, but also proposing very fundamental principle according to which magnetic field is a stationary one that does not move together with a source of magnetic field and does not belong to the source; it is not 'a form of matter', but rather is a stationary deformation of very specific part of aether – its 'fine structure' – that is responsible for all electromagnetic interactions.

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Restoring 'Ether' to Model the Magnetic Field

Continued from page 10

Wang Fei [13] says: The problem of light speed and the problem of 'ether' are in essence the same problem, if the problem of 'ether' has not been solved, even if the problem of light speed has been solved by an experiment, which essentially cannot be made clear. If the problem of 'ether' is settled clearly, the problem of light speed will come to light. However, in order to solve the problem of 'ether', we must use some experiments about the speed of light.

Hu Cangwei says [14]: In fact, my model of ether and Sir Yang Shijia's model of ether are alike. I think, the ether and real object are similar, is also made from some basic particle, the ether

of the pure electromagnetism field is an ocean that make of pair of positive electron and negative electron.

Ye Bo [15] says: the Magnetic Field is a whirlpool of the 'ether'.

A web friend (web name 101 steps), in his viewpoint of locomotion, says: The space is filled by the free electrons, light is a locomotion of the free electrons, speed of light is a speed of transferable force, the sporting direction of the electron will bend toward the direction with small resistance. [16]

Another web friend (web name jgr01234) says: an ether particle is made of a pair of positive electron and negative electron. [17]

In an article titled “Research and Argue about Special Theory of Relativity” [18], Professor Huang Zhixun points out: “New Scientist” has made a news report titled “Theory of Ether Revives with a High-Sounding, Replace the Dark Matter” in 2007, the article claimed that G. Starkman and T. Zlosnik had been driving an explain of the dark matter with a new fashion, this parlance means that the Milky May galaxy contain much more substance then visible substance. [16]

In their thesis: “the Hypothesis of conformation model of light medium” [19], Zhang Yannian and Wang Qingjie point out: Transmitting light needs a light medium, the light medium has definite static mass and internal structure and definite distributing rule. The light medium includes a particle with positive electricity and an electronegative particle at least, they may be called positive photoelectron and negative photoelectron differently. Positive photoelectron and negative photoelectron sway each other ceaselessly, taking a balance position as center, forming an electronic dipole of vibration.

Yu Benli’s thesis [20, 21] expresses the view that Einstein disliked ‘ether’, but it has still been discovered by radio astronomer. It is just a matter of time until ‘ether’ is accepted generally, this writer believes that it is the time to give a due status to the ‘ether’. We have worked out a correct summary and prediction about the basic characters of ‘ether’ according to the test result and basic theories. This writer will clarify the basic character with five aspect.

Dr Cynthia Kolb Whitney is an American scientist who wrote about optical detection of linear velocity [22]. Such detection could revive the nineteenth century concept of ‘luminiferous aether’. Any such revival would in turn support the development of twenty-first century concepts of ‘physical ether’.

3. To Model the Magnetic Field

Modern electromagnetics can almost be called a kind of experimental science, and lots of problems about it haven’t been explained by exact theories. For example, what does a magnetic field look like? What do the magnetic lines of force mean on Earth? Why can the electric current produce magnetic field? Why are the electric charges under the function of force when moving in a certain magnetic field? And now, these questions can be directly and obviously explained by making a model of magnetic field. The present work stresses the study of the substance of magnetic field around the linear electric current. And if the substance of magnetic field around the linear electric current is made clear, the substance of magnetic law can be obvious spontaneously in the other conditions [23-26]. Fig. 1 illustrates that, when there is no electric current passing through the straight wire AB, the ‘ether’ crystal around the wire is in its equilibrium position, and there is no magnetic field.

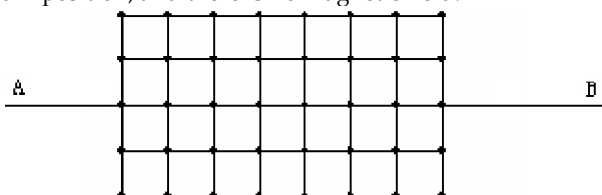


Figure 1. When there is no electric current, the ether crystal configuration is in an equilibrium position.

When there is direct current I passing through the straight wire AB, the electric current then makes the configuration of ether crystal around the wire AB sidelong. And the configuration of ether crystal inclined by the electric current away from the equilibrium position forms the magnetic field. And in this field, the strength of the magnetic field and the electric current is in direct ratio. And the disk is the zeta potential between cluster electric charges, which are tens of thousands of concentric circles vertical to the direction of electric current. However, the electric charges moving along the disk aren’t under the control of force. A corollary of this model of the magnetic field: magnetic monopoles do not exist. See Fig 2a.

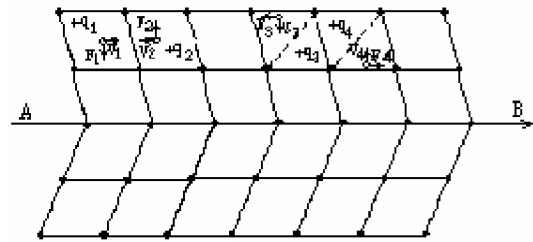


Figure 2a. Positron.

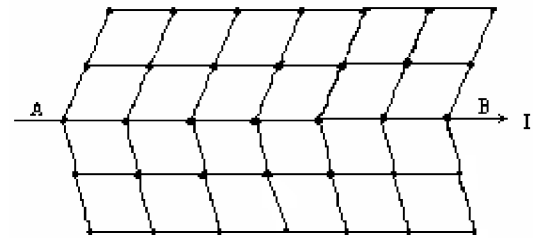


Figure 2b. Electron.

Figure 2. Sketch map of the magnetic field around the straight electrified linear lead.

- 1) When a positive charge $+q_1$ moves along the direction of the electric current, the direction of the resultant force of the conjunct function caused by the lattice electric charges nearby in the front is vertical to the direction of the electric current.
- 2) When a positive charge $+q_2$ moves against the direction of the electric current, the direction of the resultant force of the conjunct function caused by the lattice electric charges nearby in the front is vertically apart from the direction of the electric current.
- 3) The direction of charge motion will bend toward smaller resistance, so when a positive charge $+q_3$ moves vertically towards the direction of the electric current, the direction of the resultant force of the conjunct function caused by the lattice electric charges nearby in the front is opposite to direction of the electric current.
- 4) For the same reason, when a positive charge $+q_4$ moves vertically away from the direction of the electric current, the direction of the resultant force of the conjunct function caused by the lattice electric charges nearby in the front is along the direction of the electric current.

Through the above-mentioned examples, the magnitude of the force that the moving electric charges receive and the magnetic field strength are in the direct ratio, and, the magnitude of the force that the moving electric charges receive and the velocity of the movement of the electric charges are in the direct ratio as

well. Hence, magnetic force is also electric force can be concluded.

Fig. 2b means that in the configuration of the ether crystal when there are electric current pass through AB, the directions of the negatrons' and positrons' are opposite. And if explaining the situation of the force that the moving electric charges receive in the magnetic field with Fig. 2b, the same can be concluded.

While the electric current cut off, the 'ether' crystal configuration restitutes the equilibrium state and at the same time magnetic field disappears. And the model of the magnetic field accords very well as well with the electromagnetics; please study it.

To reply to my ideas recorded here, Professor Zhao Changde appraised as follows [27]: "In the website of Beijing Relativity Study Society, I saw your paper. It inspired me greatly." Another friend, named Chao Ge, says [28]: "I have seen your paper; it is a very interesting model."

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Announcement

GED reader and contributor Dr. Sorin Cosofret has launched a new publication about current research into the foundations of the exact sciences. It is in the form of a newsletter, and is to be produced as a PDF document, and distributed by e-mail. It is directed equally to physicists and chemists, as it deals mainly with quantum mechanics, electromagnetism, and thermodynamics. Dr. Sorin says:

"For more than a century, chemistry has been considered a simple appendix of physics. This situation needs a reconsideration and it is high time for chemistry to find its own way..."

"The first topic encompasses the concept of quanta and I suppose it is not necessary to make an introduction for this the-

ory, which is considered the most exquisite theory ever developed.

"Many cut off experiments related to quantum idea have been already published on Elkadot website, but as far we are doing the warming up, the newsletter presents only some consequences of quantum idea in every day life."

He then goes on with an every-day example involving the seaside, and his kitchen. I love it! CKW

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On the Testing of Einstein's Relativity

Introduction

Einstein's Relativity Theory (RT) is composed of two parts: his theory of observation, or Special Relativity Theory (SRT), and, based on SRT, his theory of gravity, or General Relativity Theory (GRT). The two parts of RT differ in mathematical sophistication. In SRT, all physical processes were originally described by very simple algebraic expressions. By contrast, GRT uses a very complex tensor apparatus.

It is generally believed that SRT is confirmed in all experiments and observations presently known. But all experimental 'confirmations' of SRT also admit some simple classical explanation. So really, the status of SRT is, at best, 'not yet disconfirmed'.

History of Critiques

Since their inception to the present time, SRT and GRT have undergone sharp criticism. The authors of most critical papers first assert that SRT has been confirmed in all experiments, and must therefore be correct, and then criticize the statements and conclusions of GRT (L. Brillouin, A.A. Logunov, *etc.*). In our opinion, if the validity of SRT is recognized, then it does not make any sense to criticize GRT, because GRT is a logical extension of SRT.

The predictions from SRT are that, in uniformly moving objects: lengths contract, masses increase, and time passes slower. GRT predicts fantastic phenomena such as expansion of the Universe, the Big Bang, black holes. If GRT is indeed an extension of SRT, then these too are, in essence, consequence of SRT. So let us here focus on SRT.

The basis of SRT is its two Postulates. Postulate 1 is the Principle of Relativity (PoR), that the laws of physics are the same in all inertial frames of reference. Postulate 2 is the invariance of the speed (the constancy of light speed in vacuo).

Experiments

The fallacy of SRT can be proven experimentally only by refuting the statement, "confirmed by all known experiments and observations", and by disproving SRT's basic Postulate - its Second Postulate, asserting the invariance of light speed.

Einstein's PoR is considered an extension of the Galilean PoR by application to electromagnetic and optical phenomena. The Galilean PoR states the equivalence of inertial frames: no experiments conducted within an inertial frame can possibly determine in which direction and at what speed the frame moves relative to another frame. Considering the example of a ship in a lake, Galileo showed that all experiments in the hold of the ship occur equally, regardless of whether the ship is in uniform motion or at rest.

To this PoR, Einstein added that the direction and speed of an inertial frame cannot be determined with electromagnetic and optical phenomena. And he did not say that the source and the observer have to be inside the frame. That is, only internal and

not external signals have to be used when the motion of the frame is being determined. But Galileo clearly emphasized that, if the observer exits out of the hold to the deck, he will see that the ship moves relative to the shore. That is, external signals, coming from another frame, can reveal the state of motion of the initial frame.

Michelson interference experiment is considered as an important confirmation of SRT. But in fact, it confirms only Galileo's PoR, because in Michelson experiment, the source and receiver are in the same inertial system. But also, the phenomenon of stellar aberration in which the observer sees light coming from the stars allows reliable determination of the direction and speed of the Earth relative to the inertial frame of the stars.

The essence of SRT is most clearly revealed in its Second Postulate, claiming that the speed of light is the same in all inertial frames, and does not depend on the motion of the source, or of the observer measuring this speed. All erroneous conclusions in SRT - length contraction, increase of mass, and time dilation - logically follow strictly from this Postulate. Because of this Postulate, the classical Doppler effect is replaced by a relativistic effect.

By the early 20th century, all experiments and observations convincingly proved that the speed of light is independent of the motion of the **source**, but there was not one experiment or observation regarding the motion of the observer. Einstein, referring to the equivalence of inertial frames, came to an erroneous conclusion that the motion of the observer, measuring the speed of light, also was equivalent to the motion of the source, and therefore claimed that the speed of light did not depend on the motion of the **observer**.

Einstein's Second Postulate states that, with respect to the measuring device, the speed of light cannot be different from c . That is, the observer moving toward the beam with an arbitrarily large constant speed v and measuring the light speed always gets the same value of $c = 299,792,458$ m/s, and *not* $c + v$.

In addition to Michelson's experiment, as the main confirmation that the speed of light can not exceed c , SRT considers interferometry experiments in moving water with light dragging, as carried out by Fizeau in 1853. It is believed these experiments prove partial, but not complete, dragging of light by moving water, and therefore at any speed of the medium, the speed of light cannot exceed the value of c . It is shown in our papers [1,3] that a wrong conclusion is drawn because the analysis ignores the change in frequencies of interfering beams. Due to the phase shift of the wave fronts, the fringe shift is less than expected, and this fact is erroneously explained with partial dragging of light. In fact, light is dragged not partially, but completely. Essentially, Fizeau experiment does not confirm, but rather refutes SRT.

Inferences

Because the classical Doppler effect was replaced with the relativistic effect, a cosmological red shift was explained only in terms of recession of galaxies. As a result, the hypothesis of the

Expanding Universe was born. Resulting from this, the myths of the Big Bang, giant star clusters, black holes, *etc.*, came into existence.

The fact that the motion of the observer is not equivalent to the motion of the source is clearly confirmed by the phenomenon of stellar aberration: aberration surely occurs when the observer (together with the Earth) moves, but is completely absent when the source (the star) moves, which is confirmed by observations of double star systems. SRT cannot explain this phenomenon, which therefore, clearly contradicts it. The absence of aberration when the star moves has simple classical explanation. In [2], it is shown that the aberration is absent when the star moves because the light from the star re-emitted by the interstellar medium travels to Earth with the speed c/n , which is constant relative to the medium, and does not depend on the motion of the star.

Though stellar aberration obviously contradicts SRT, and both the Fizeau experiment and the Sagnac effect cannot be explained by SRT, but have a purely classical explanations, and the experiments to check the speed of light by moving observers are proposed [4-6], relativists nevertheless continue to claim that SRT is correct.

A Way Forward

The fallacy of SRT, and GRT based on it, lies with the measurement of the speed of light by a moving observer. The observer moving with speed v towards the light beam will register a value $c+v$, which is greater than $c = 299,792,458$ m/s, which refutes the basic Postulate of SRT; *i.e.* the invariance of light speed.

The following experiment can clearly prove the falsity of the light-speed invariance Postulate, and the fact that the light can travel relative to the inertial frame of the observer at speed greater than c . Two identical GPS satellites, S_1 and S_2 , with atomic clocks precisely synchronized before launch, move in the same orbit around the Earth. Since the satellites and the clocks experienced the same acceleration, and move at the same speed v , relativists cannot claim that the clocks in orbit are not in sync.

At time t_1 , satellite S_1 sends a coded radio or optical signal containing time t_1 . Satellite S_2 receives the signal at time t_2 and determines the time difference $t_2 - t_1$, which is the time during which the signal travels from S_1 to S_2 . Similarly, satellite S_2 sends a signal to S_1 , and S_1 determines the time during which the signal travels from S_2 to S_1 .

The time from S_1 to S_2 will not equal to the time from S_2 to S_1 . This is because the signals travel with identical speed c/n relative to the atmosphere and with different speeds $c+v$ and $c-v$ relative to the satellites.

At the moment of radiation, the signal moves at speed c relative to satellite S_1 and at speed $c-v$ relative to the atmosphere. The signal is re-emitted by the atoms of the atmosphere and then travel relative to atmosphere with speed c/n , almost equal to

c . Relative to satellite S_2 , the speed of the signal is equal to $c+v$. That is, the distance L from S_1 to S_2 is covered at speed $c+v$; greater than c .

Similarly, the signal from satellite S_2 enters the medium at an initial speed $c+v$, and after re-emitting, travels at speed c relative to the atmosphere and at speed $c-v$ relative to satellite S_1 .

Thus, the signal from S_1 reaches S_2 by the time increment $t_2 - t_1 = L/(c-v) - L/(c+v)$ sooner than the signal from S_2 reaches S_1 . The time difference arises only because of the fact that the signals travel relative to the inertial frame of satellite S_1 (or S_2) with the speed $c+v$ in one direction and with the speed $c-v$ in opposite direction. For speed $v = 3.9$ km/s and distance $L = 27,227$ km between the satellites, the time difference will be about $2.4 \mu\text{sec}$, and can be easily measured.

A similar experiment can be conducted in interplanetary space with two space ships, moving, for example, towards Mars. In this case, the ships travel with greater speed relative to the medium and, therefore, the time difference will be greater. For speed $v = 24$ km/sec and the same distance $L = 27,227$ km between the ships, the time difference increases to $15 \mu\text{sec}$.

Conclusion

The time difference in the experiment cannot be explained with any relativistic effects. It can be explained only with the dragging of light by the moving medium, and unequivocally disproves the Postulate of the invariance of light speed, - the basic Postulate of Einstein's SRT.

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