Technical Note

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Gravity control with help of de Rham cohomology

Abstract

A new promising technology for gravitational control is presented based on research work at Tohoku University. Using a gyroscope made of brass and non-magnetic materials, the asymmetrical weight reduction effect reported in 1989 was fully studied and confirmed in Porto, Portugal to attain PhD at Oporto University. The theoretical and experimental research work based on De Rham cohomology suggests the existence of a new gravitational fundamental interaction in nature of infinitesimal small range mediated by a new class of elementary particles (massless spin-zero bosons) which we may call anti-gravity. We present here briefly a summary of non-systematic and systematic results as well as practical guide ways for the development of antigravity technology in industry. This article intends briefly to cover historical, theoretical and experimental aspects of the research work as well as giving future direction for the practical implementation of the technology with emphasis on its use for electrical power generation.

HISTORICAL INTRODUCTION

Since ancient times, human beings looked at the stars and studied the astrological dynamics. These studies were used to plan agriculture, city buildings alignment with the sun, forecast the future and even to develop astrological identification with characters.

Johannes Kepler (1571~1630)[15] formulated the Kepler empirical laws, which stated that: 1st The orbit of every planet is an ellipse with the Sun at one of the two foci, 2nd A line joining a planet and the Sun sweeps out equal areas during equal intervals of time and 3rd the square of the orbital period of a planet is proportional to the cube of the semi-major axis of its orbit.

The notion of elliptical orbit was a major breakthrough at the time and to engage future generations of researchers in the study of planetary motion.

Isaac Newton (1642~1727)[16] based on calculus of the time, derived the Kepler laws as well as the universal law of gravitation[17]:

$$F_g = G \frac{m_1 \cdot m_2}{r^2} \quad [N] \tag{1}$$

F_g is the force of gravity between masses m_1 and m_2 at a distance r. G is Newton's universal gravitational constant 6.6738×10^{-11} $[m^3 \ Kg^{-1} \ s^{-2}]$.

Siméon Poisson (1781~1840)[18] generalized Newton's universal law of gravitation into a partial differential equation as follows:

$$\nabla^2 \Phi = 4\pi G \rho \tag{2}$$

In which Φ is a scalar gravitational potential and ρ is the mass density of the gravitational field source.

By late XIX century, the nature of light was still a mystery and the majority of the scientific community believed in the existence of the luminiferous aether[19]. The luminiferous ether would play the role of medium by which light travels in a correspondence to the medium by which sounds propagate in different materials.

The scientific community of late XIX century suspected that the nature of light waves and sound waves were the same. As with many theoretical proposals they must be validated by experimental results.

Albert Michelson (1852~1931)[20] and Edward Morley (1838~1923)[21] proposed the "Mickelson and Morley"
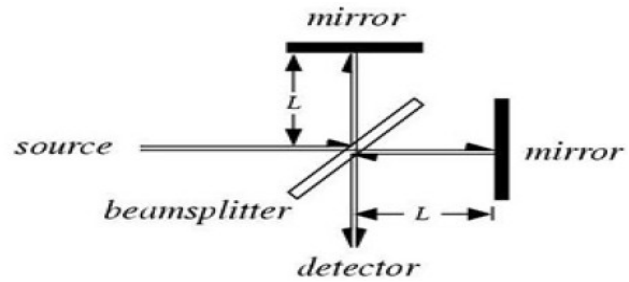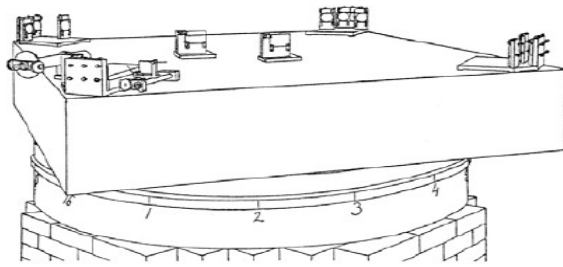
experiment[22]:

Figure 1 : Michelson and Morley's experiment illustration and scheme.

This experiment consisted in a beam of light that is split along its path. The two beams travel the same distances but on perpendicular paths and are mirrored back to the beam splitter for recombination. They are then orientated towards the origin.

Any slight variation in the velocity of each beam would cause interference in the recombination beam that could have been easily seen at the final beam projection as patterns fringes of light.

The negative results from early 1887 and subsequent improved experiments lead to the conclusion that the luminiferous aether did not exist.

Albert Einstein (1879~1955)[23] based on the Mickelson and Morley experiment proposed the unification of space and time into a mathematical theory called "Special Relativity" in 1910. One must take note that Special Relativity does not take gravity into account. In this theory we consider the laws of nature and particles interaction in a Minkowski[24] flat space-time with a flat metric signature of (-+++) or (+—).

In this framework, Lorentz transformations[25,26] were valid and Maxwell equations[27,28] were found invariant under Lorentz transformations, so the theory gave the famous relation of mass and energy for an inertial observer:

$$E = m \cdot c^2 \ [J] \tag{3}$$

The fact that Maxwell equations were found to be invariant to Lorentz transformations and the mathematical beauty of the theory favored the admiration of the scientific community at the time.

One must take note that quantum mechanics started to develop in the 1920's and Bohr[29] atom model that depicts emission and absorption of photons by electrons was introduced in 1913[30].

The problem arised with the introduction of the weak gravitational interactions into the special relativity theory by Albert Einstein.

Max Abraham (1875~1922)[31] based on a suggestion by Albert Einstein in 1911[32], developed a scalar non relativistic theory in 1912[33] which gave as result a slight correction of Newton's universal gravitational law, of opposite sign and inversely proportional to the cubic power of distance:

$$F_g = A \frac{m_1 \cdot m_2}{r^2} - B \frac{m_1 \cdot m_2}{r^3} \quad , \quad \frac{B}{A} < 10^{-8} \quad [N] \tag{4}$$

In Dr Max Abraham theory light velocity depends on the gravitational potential difference between emission point and observer with non-linear squared root relation and as consequence Lorentz invariance does not hold in the presence of weak gravitational interactions[34].

After the introduction of General Relativity in 1915[36] by Albert Einstein, which is a four dimensional generalization of Poisson equation in which the gravitational potential is described as a 2nd rank tensor (metric tensor), a question remained as to which theories would in fact be the correct ones to describe the nature of the gravitational field.

Given that the gravitational potential in Poisson equation is a scalar entity, perhaps in the mind of Dr Max Abraham, its generalization would be better described by a four dimensional scalar theory. This theoretical change in the description of the weak gravitational field should be one of the reasons Dr Max Abraham though general relativity was not the right path to the development of physics.

Therefore an experiment was needed at astronomical scale to achieve theory validation through experimental measurement. And the best candidate for this result would be to measure the light deflection of 1.75 arcsecond (1.75") in the vicinity of the Sun during a solar eclipse. As the scalar theory of Max Abraham as well as Newtonian theory predicted 0.87 arcsecond (0.87"), half the light deflection value of General Relativity a good measurement would lead to conclude which of them was right.

Many attempts were tried from 1915 on, but the majority of them failed due to bad atmospheric conditions.

Arthur Eddington (1882~1944)[37] with help of the Portuguese navy, traveled to the São Tomé and Príncipe Portuguese islands near Africa to take photographs of a solar eclipse in 1919.

The pictures taken by Eddington were also carefully analyzed by Sommerfeld[38] and due to the radial distance of the stars in the pictures the result could not be due to diffraction due to the Sun's atmosphere. So the result at the time still valid today indicated clearly a light deflection of 1.61±0.30 arcsecond (1.61 ±0.30")[39].

The Eddington results, suggested without a doubt, that

General Relativity were in fact at the time a better candidate to the description of the gravitational field than Newtonian or four-dimensional scalar theories. For this reason the scalar theories did not for a long period of time get as much attention.

However, we can find even today in the general literature suggestions that gravitational scalar theories can also give the same predictions as General Relativity[40]. The minority of researchers, who still work on gravitational scalar theories, can overcome the theoretical difficulties of early XX century and present scalar theories that can in fact be compared to General Relativity.

In the case of the Mickelson & Morley experiment, Ernest Silvertooth[41] and Richard Muller[42] have performed experiments with consistent results of measuring Earth's drift through absolute space. The argument is that its logic fails if we take into account the relation:

$$c = \nu\lambda \ [m \cdot s^{-1}] \tag{5}$$

If the source and the receiver of the beam are commoving, and if c (the speed of light) changes, then λ (the wave length) must also change. Therefore it is impossible to measure the one-way velocity of light by the standard Mickelson & Morley setup because a small increase in c would imply the same increase in the wave length λ and the beam would pass the same point with similar time lapse hiding the similar change in the two parameters.

It was possible then with a two path experimental setup to measure a velocity of the Earth of $\sim 378 \ [Km \cdot s^{-1}]$[41] and with the modified U-2 plane setup of $\sim 400 \ [Km \cdot s^{-1}]$[42] towards the Leo constellation. The consistent results differ by a margin of $\sim 5.5\%$ (APPENDIX I - Summary of aether drift experiments measuring Earth's velocity in absolute space).

During the XX and early XXI century, several authors measured an asymmetrical weight reduction effect in the Russia[43], United States[44], Japan[1,3,4] and Europe[12,13]. One should note, that according to classical mechanics it is not possible for a rotating mass to loose weight by any means with rotation.

The researchers who were not able to measure such an effect, clearly did not conduct the experiment with the correct scientific method nor have clearly understood the essence of the problem they were facing[1,3,4,12,13].

Eric Adelberger[14] comments are relevant as they indicate the general accepted notion of spin of elementary particles might need to be revised. We think that spin has no direct physical meaning. Spin of elementary particles has no direct relation with intrinsic angular momentum and is just a quantum parameter of the wave function associated with elementary particles otherwise Eric Adelberger's arguments should hold firmly based on standard physics knowledge at present. Electromagnetic interactions should be regarded as interaction between electron spin-spin resulting from photon exchange rather than intrinsic fundamental property of an isolated elementary particle with charge and spin[50]. Charge and spin should be regarded as quantum parameters of the theory without any direct physical meaning.

We have no doubt that by using the correct experimental method it is possible to measure completely asymmetrical weight reduction effect in the order of milligrams in the clockwise rotation viewed from above according to the following law[1]:

$$\Delta W_R(\omega) = -6.77 \times 10^{-14} \cdot c \cdot M \cdot r_{eq} \cdot \omega \ [mg] \tag{6}$$

In which $-6.77 \times 10^{-14} \ [m^{-1}]$ is a transformation coefficient obtained experimentally, c is light velocity, M is the mass of the rotor, r_{eq} is the equivalent radius and ω the rotor angular frequency.

Both weight scale experiment[1,12] and free fall experiment[3,44] suggest undoubtedly that it is in fact a gravitational effect, i.e., the gravitational field fluctuates with the rotational motion of a macroscopic object.

One should expect, according to the current gravitational theories, an effect associated with the rotational motion of a macroscopic effect. But none of the current gravitational theories predicts an effect of this order of magnitude. According to our calculation a weight reduction of 13 milligrams at 13000 rpm of a rotor mass of 200 [grams] is equivalent to the practical compensation of the gravitational field produced by a moon of $\sim 300 \ [Km]$ radius in the center of the Earth.

We can then conclude that in addition to the effects predicted by the current accepted theories there is an additional effect that we can characterize theoretically as of topological nature.

The study of topology has brought new mathematical tools to describe non-trivial space-time topologies. It is well known that space-time as an incomplete manifold has non-trivial topology at the scale of Max Planck constant $\sim 10^{-33} \ [cm]$.

In special, the use of de Rham cohomology (a branch topology in which the nil operator is the differential operator) can led to very serious theoretical results. Stanley Deser[9], using de Rham cohomology in a D=3 space, concluded that if the spin of elementary particles could be controlled by magnetic field, that a violation of the equivalence principle could take place as well as anti-gravity could be generated. Of course in practice the spin is an intrinsic property of elementary particles and cannot be changed, but the conclusions of the article are nevertheless quite serious and interesting.

On the other side, the use of de Rham cohomology of an invariant 4-dimensional angular momentum can lead to real physical results as follows:

A topological theory developed by Dr Hideo Hayasaka based on de Rham cohomology was published in St Petersburg academy of science in 1994[2].

It is concluded that the rotational motion of an macroscopic object can produce a positive gravitational potential that does not manifest in the field equations calculation by means of integral over a two-dimensional closed space-like surface method leading to an indefiniteness of the gravitational force associated with the rotational motion of a macroscopic object.

In this theoretical construction and study of the gravitational force indefiniteness, the weight reduction effect is the natural result of the topological properties of 4-dimensional angular momentum.

Considering a point mass in a Minskowsky flat space-time, rotating in the horizontal plane in a constant velocity it is straightforward to understand that we have a mirror transformation between right and left 4-dimensional gravitational moments.

This relation is briefly characterized mathematically as:

$$\frac{1}{c}\int\left\{x^{\mu}f^{\nu}(L)-x^{\nu}f^{\mu}(L)\right\}dx^{0}=\frac{1}{c}\int\left\{x^{\mu}f^{\nu}(R)\right.$$
$$\left.-x^{\mu}f^{\nu}(R)\right\}dx^{0} \qquad (7)$$

Here we use the Einstein notation for indexes (0 is time dimension and 1,2,3 are spatial dimensions XYZ). Since we are rotation on a horizontal plane, indexes 1 and 2 assume no relevance, as their variations are cyclic. We are then interested on the 0(time) and 3(Z) components.

Taking into account the de Rham cohomology theorem developed by Georges de Rham[45], if the integrals of two quantities Ω and Ω' are equal along a closed path C, there is a difference provided by an exact differentiation $d\chi$ between Ω and Ω which can be described mathematically by:

$$if \quad \oiint_{C}(\Omega-\Omega')=0, \quad then \quad \Omega-\Omega'=d\chi\neq0 \qquad (8)$$

After applying the above theorem to the mirror transformation of 4-dimensional angular momentum with indexes 0 and 3, we can say that there exists a gauge transformation between the gravitational moments in the right and left direction viewed from above.

We arrive at the conclusion that there is a difference different from zero between the vertical component of the gravitational force in the right and left rotation as follows:

$$f^{3}(L)-f^{3}(R)=-\frac{c\sum_{N}A_{N}N\frac{\omega}{c}\sin N\frac{\omega}{c}x^{0}}{x^{0}} \qquad (9)$$

For a large N we can describe the right hand side as a sum of pulse functions (Dirac δ function) with respect to time x^{0}.

For a weight reduction in the order of milligrams, one should expect N to be quite large, and therefore, the higher

frequency modes, should take more relevance in the overall effect.

This implies, planning an experiment with precision, otherwise, the extreme high frequency modes will be cutoff by the mechanical vibrations or physical connections of the gyroscope to the power source. This was one major point that some research groups did not take into consideration when trying to confirm the weight reduction effect.

Finally, as reported in[2], the new transformation ($\dot{\Gamma}$ in which the point notation denotes the presence of anti-gravity) describing this local geometrical change in space time falls into the same category as the λ-transformation proposed by Einstein[46] and Trautman[47] as follows:

$$\dot{\Gamma}^{\mu}_{\nu\lambda}(\zeta)=\Gamma^{\mu}_{\nu\lambda}+\alpha(\zeta)\theta^{\mu}_{\nu}(\zeta)\frac{\partial I}{\partial x^{\lambda}} \quad \left[m^{-1}\right],$$

$$I=\int\frac{\sum_{N}N\cdot A_{N}\cdot\sin\left(N\cdot c\cdot\omega\cdot\left(x^{0}-(n-1)\cdot c\cdot T\right)\right)}{x^{0}-(n-1)cT}dx^{0} \quad \zeta=L,R \qquad (10)$$

In which $\alpha(\zeta)$ is an experimental parameter, θ^{μ}_{ν} is a mixed tensor and I is an integral function representing a sum of Dirac δ functions for large N and that depends exclusively on x^{0}.

We can then conclude that the right hand anti-gravitational term vanishes for $\lambda\neq0$.

The specific curvature induced by the new transformation is not presented here, but instead of the null curvature induced by the λ-transformation proposed by Einstein[46] we will have a curvature that depends on the sense of rotation $\dot{R}^{\rho}_{\sigma\mu\nu}(R)\neq\dot{R}^{\rho}_{\sigma\mu\nu}(L)$, $\dot{R}^{\rho}_{\sigma\mu\nu}(L)\cong R^{\rho}_{\sigma\mu\nu}$.

By analyzing Dr Max Abraham non-relativistic gravitational theory[33], which includes an anti-gravitational correction to Newton's law, we can infer that this term corresponds to a new fundamental gravitational interaction, mediated by a massless spin-zero boson. We have decided to name this new particle the Aether boson (ε'). It has a measured group velocity $\nu\geq1,000,000,000c$[35] and an imaginary proper time.

Considering the Newton's law approach, the local density of the gravitational field of the Earth is given by the following formula:

$$E_{g}=-\frac{g^{2}}{8\cdot\pi\cdot G} \quad \left[J\cdot m^{-3}\right] \qquad (11)$$

It is most natural that the weight reduction effect is directly the result of a local production of a positive density of energy (gravitational positive potential). With the rotational motion of a macroscopic object, under specific experimental conditions, a phase transition of the mass of elementary particles takes place.

In this excited phase, occurs a natural inflow of energy, from the vacuum quantum fluctuations to a massless spin-zero boson that becomes excited from his ground state.
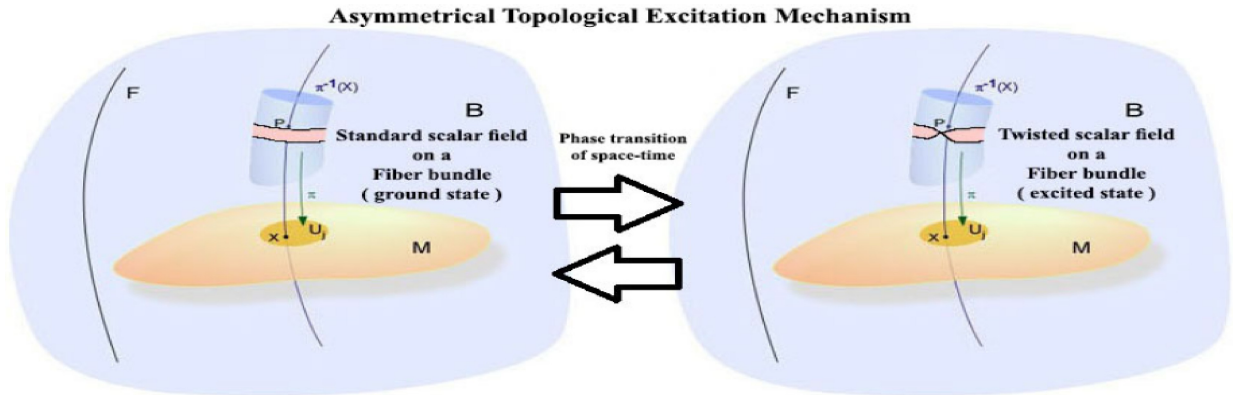
Figure 2 : Fiber bundle (B, M, π, F)[5] illustration of the standard and twisted scalar field in space-time. The twist of the bundle raises the energy of the scalar field in space-time.

As described by C. Isham[6] and G. Gibbons[7], the existence of massless scalar field in space-time is a cross section of the bundle. This cross section has the capability to change its topology, from a standard cross section band (fundamental state) to a twisted section similar to well known Möbius strip resulting in a double covering of a circumference (excited state/twisted field state).

The twist/torsion of space-time, just rises the value of the energy of the field from its degenerated minimum[2,10-13,48]. The integral of the massless spin-zero bosons excited energy during the clockwise rotation viewed from above, just corresponds to a local positive density of energy of scalar origin.

Of course, during the counter-clockwise rotation viewed from above, there exists also a local positive density of energy, but statistically it remains close to its ground state and does not manifest macroscopically to current experimental measurement technological capability.

The local positive energy generated, adds to the negative energy density of the attractive gravitational field of the Earth and the weight is affected.

EXPERIMENTAL APPARATUS AND RESULTS

We have spent several years improving our experimental method and it is extensively described in[12,13].

We will briefly describe here our experimental setup and give a list of non-systematic results during our study of the effect as well as brief error bar graphic of our systematic results of Nov 2009. All experiments were conducted in Porto, Portugal (latitude = 41.169 N, longitude = 8.600 W, height = 148.5 meters), from May 2004 to November of 2009.

The detailed data of the systematic results will be published in the United States in the near future[13].

Our experimental setup consists of a Mettler Toledo analytical balance AX 504 with capacity to weight up to 510 grams with a precision of 0.1 milligrams, a tachometer HHT-1501 from OMEGAETTE, an air cooled Alcatel PDR 250 diffusion pump, an EDWARDS Active Pirani Vacuum Gauge APG100 and a vacuum pump PASCAL 2005 from Alcatel.

Our Software for data acquisition and logging was developed in MATLAB and named "Automatic System for Weight Measurements" (ASWM).

Figure 4 shows the experimental setup scheme[12]:

Next a series of weight reduction results in the clockwise rotation attained during the study is presented:

The systematic asymmetrical weight reduction results complete graphics attained in November 2009 as well as the first result of 26 milligrams at 18000 rpm will be published in the near future[13]. The main improvement was the replacement of wire contacts by mercury contacts as well as the use of correct balance pan vibration damping material in order to allow free infinitesimal mechanical vibrations of the gyroscope of extreme high frequency ≥ 50 [GHz].

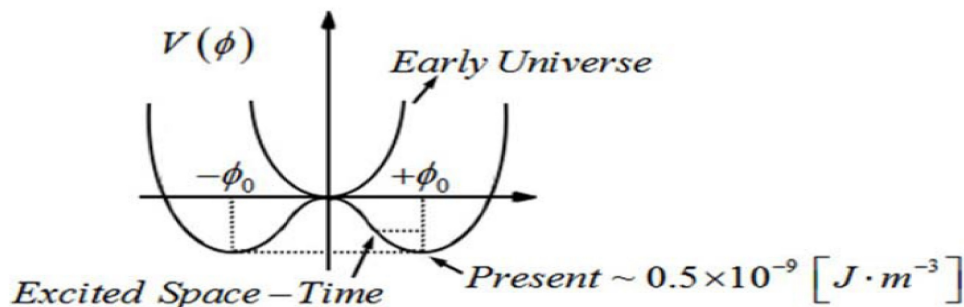Here we present shortly the vertical error bars corresponding

Figure 3 : Potential V(ϕ) of massless spin-zero boson excitation mechanism from its ground state $\pm\phi_0$.

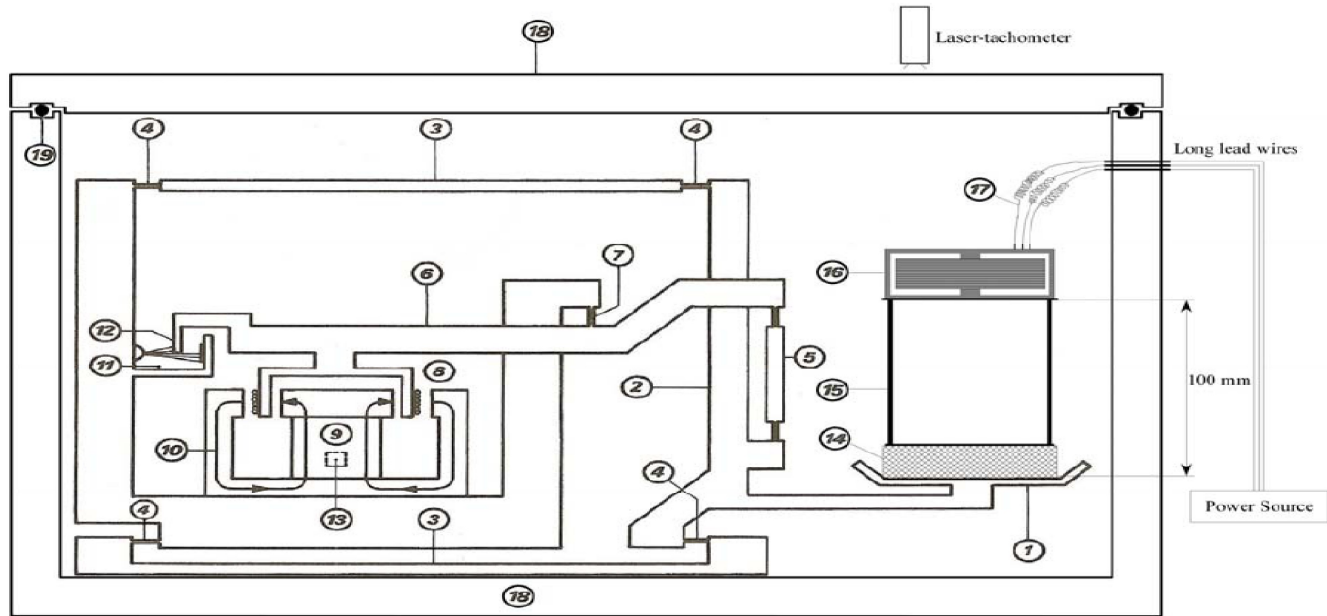Laser-tachometer

Long lead wires

100 mm

Power Source

Figure 4 : Illustration of experimental apparatus for asymmetrical weight measurements of a spinning gyro. 1, balance pan with dimensions 90x90mm; 2, suspension; 3, support for guiding the balance pan weight transfer; 4, flexible support; 5, connecting rod; 6, handle for the transmission of the weigh-force; 7, suspension of the handle; 8, coil of compensation; 9, permanent magnet of the electrodynamic converter; 10, circuit of the magnet; 11, positioner; 12, position indicator; 13, sensor for the compensation of temperature; 14, polyurethane foam pad. 15, aluminum support structure; 16, gyro; 17, super-fine wires with very small spring constant; 18, transparent acrylic vacuum chamber with 15mm thickness; 19, o-ring.

TABLE 1 : Asymmetrical weight reduction results (in the clockwise rotation viewed from above) histogram attained in Oporto (Portugal) in milligrams. Systematic results of the expected order of magnitude were attained on November 2009.

Date	Weight reduction in the clockwise direction [milligrams]	Rpm	Count	Count Sum	Date	Weight reduction in the clockwise direction [milligrams]	Rpm	Count	Count Sum
2004-05-17	-26.4	18000	1	1	2006-04-17	-2.7, -2.5, -2.7, -2.4	13000	4	46
2004-05-18	-4.0	13000	2	3	2006-04-19	-4.3, -10.0, -3.6, -7.6, -5.0, -2.5	13000	6	52
2005-11-20	-4.0, -8.0, -9.0, -9.0	13000	4	7	2006-04-20	-2.8, -4.2, -5.2	13000	3	55
2005-11-25	-5.1	13000	1	8	2006-04-21	-2.5, -2.2	13000	2	57
2006-01-04	-2.0, -2.3	13000	2	10	2006-04-22	-3.8	13000	1	58
2006-01-07	-1.7	13000	1	11	2006-04-22	-5.2, -5.3, -8.1	13000	3	61
2006-03-05	-2.3	13000	1	12	2006-04-24	-2.8	13000	1	62
2006-03-09	-2.3	13000	1	13	2006-04-25	-4.7	13000	1	63
2006-03-10	-2.9, -1.3, -1.4, -2.1	13000	4	17	2006-04-26	-6.7, -6.5	13000	2	65
2006-03-11	-1.4	13000	1	18	2006-04-27	-6.6	13000	1	66
2006-03-15	-1.3, -1.4	13000	2	20	2006-04-29	-2.9	13000	1	67
2006-03-16	-1.8, -1.5, -1.5	13000	3	23	2006-04-30	-1.8	13000	1	68
2006-03-17	-2.6	13000	1	24	2006-05-02	-5.5, -6.8	13000	2	70
2006-03-18	-2.4	13000	1	25	2006-05-04	-3.5	13000	1	71
2006-03-20	-2.5, -2.7, -2.0	13000	3	28	2006-05-05	-3.7, -3.8, -4.3	13000	3	74
2006-03-21	-2.3, -2.1, -1.6, -1.9	13000	4	32	2006-05-06	-5.1, -2.7, -2.4, -2.6, -4.8, -1.2, -1.9, -2.5	13000	8	82
2006-03-22	-1.1, -1.4, -1.1	13000	3	35	2006-05-07	-4.8, -2.2, -2.6, -2.8	13000	4	86
2006-04-13	-1.9	13000	1	36	2006-05-08	-3.2, -4.8, -3.5, -2.8	13000	4	90
2006-04-14	-2.8, -1.4, -2.2, -1.2	13000	4	40	2006-05-09	-1.9, -4.0, -2.2	13000	3	93
2006-04-15	-1.2	13000	1	41	2009-11-17	-13.0, -13.0, -13.0, -13.0, -13.0, -13.0	13000	6	99
2006-04-16	-2.9	13000	1	42					

to the systematic results. The graphics axis represent rotational velocity (3000 ~ 13000 Rpm) *vs.* Inverted weight loss (5 ~ -15 Milligrams). The expected value according to[1] is represented by solid lines.
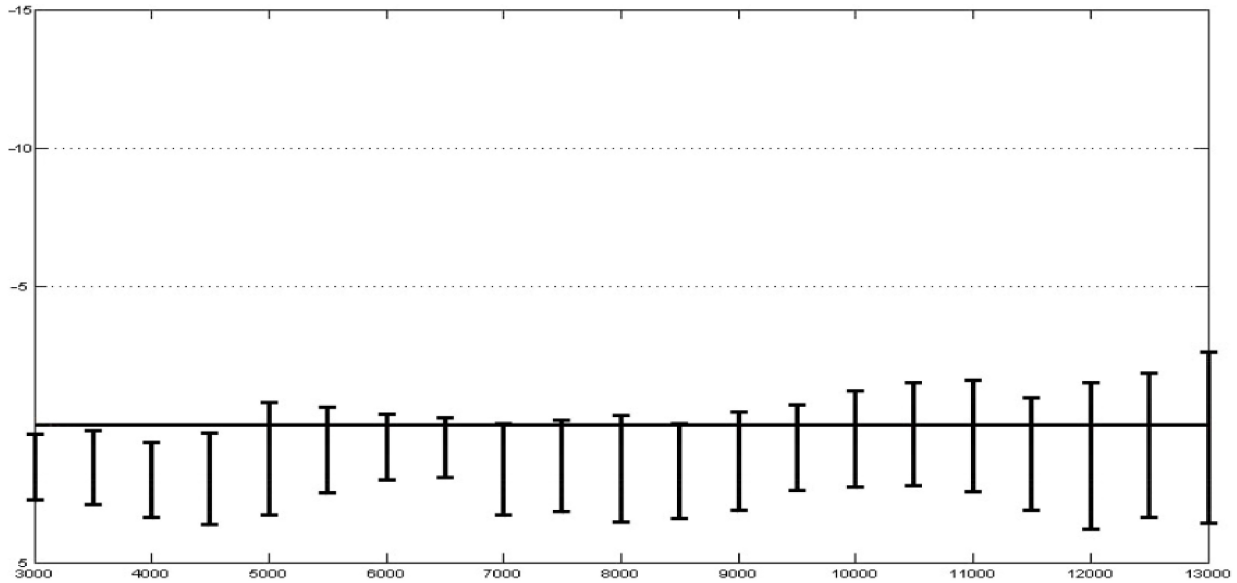
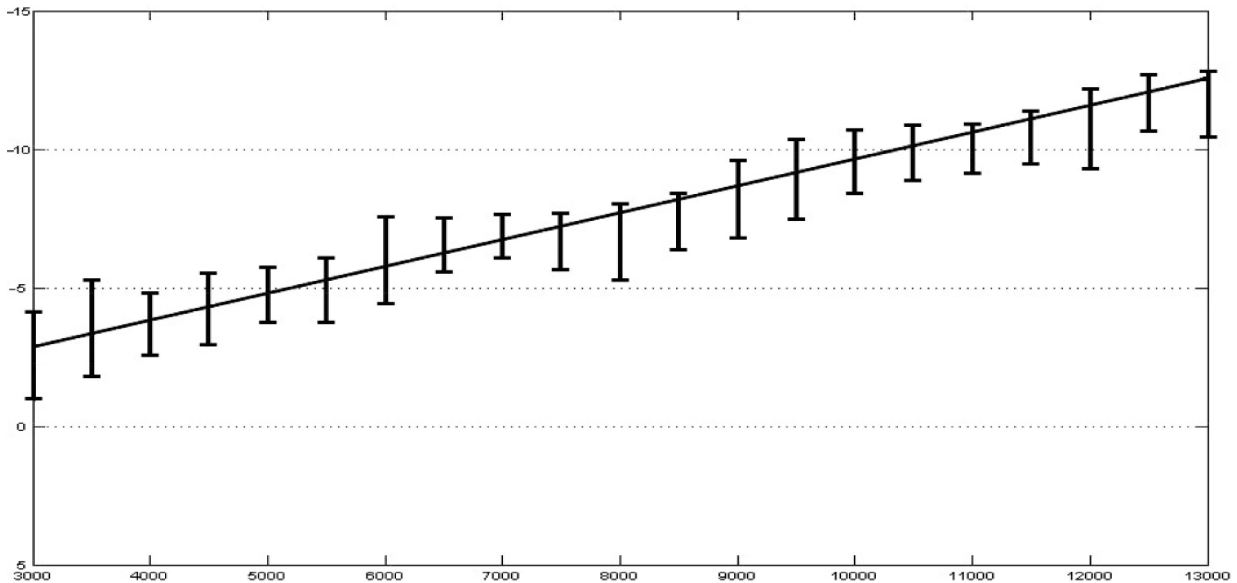Figure 5 : Counter-clockwise systematic weight reduction vertical error bars.

Figure 6 : Clockwise systematic weight reduction vertical error bars.

GRAVITY CONTROL DUE TO TOPOLOGICAL EFFECT OF CIRCULATING MAGNETIC FLUIDS

The above described technological principle can be applied in all fields of industry[3,4,10-13,48,49,54] (energy, transportation, logistics, health and space exploration). Gyro experiment is just used to conclude the macroscopic study of a asymmetrical weight reduction in the order of milligrams.

To reach a practical level of gravity control several technological options are possible, we present here the use of ferrofluids as an example for its wide availability on the market and its relatively cheap price as follows:

According to Heisenberg (1928)[50] and Van Vleck (1932)[51] model, ferromagnetism is understood as due to the ex-change interaction between electron spin-spin. Two spin waves directing in the reverse directions of each other form a magnon which is regarded to be a boson.

As for the phenomenological exchange function based on Heisenberg model[50], H is given by

$$H = A \sum_{\alpha} \sum_{\mu} \left(\frac{\partial M_{\alpha}}{\partial x_{\mu}} \right)^2 \quad [J] \tag{12}$$

Here, A is an arbitrary coefficient depending on the number of spins, the exchange integral of spin-spin and atomic distance. α and μ denote coordinate variables. M is the magnetization of magnetic material. If the gradient of magnetization $\frac{\partial M_{\alpha}}{\partial x_{\mu}}$ is not zero, the exchange function H is not zero. If all the spins are arranged completely along an axis, H is zero, that is, there is no exchange interaction energy of spins. The interior energy E based on Heisenberg

model is provided by the topological theory of magnons. The energy density E is given by

$$E > 8\pi N \times 10^{-7} \; [J \cdot m^{-3}] \tag{13}$$

N is the number of spins per unit volume, which is a topologically invariant quantity and is almost arranged along external weak magnetic field.

On the other hand, the potential energy U in the presence of the Earth's attractive gravitational field[52] is given by

$$U = -\frac{g^2}{8\pi G} \; \left[J \cdot m^{-3} \right] \tag{14}$$

If the sum of the positive potential energy E as an excited volume and the attractive potential energy U, i.e. $E + U = 0$, the volume surrounding the generator will feel a null gravitational force, through the topological excitation in the clockwise rotation around a specified direction. From Eqs. (13) and (14), the condition is:

$$N = \frac{g^2}{(8\pi)^2 \, G \times 10^{-7}} \; \left[m^{-3} \right] \tag{15}$$

For instance, in case of a magnetic fluid, the number of 3d-spins (3d-spins of ferrite $Fe_2O_3 \cdot FeO$) along the vertical direction N_{3d} must satisfy the following relation:

$$N_{3d} = 2.5 \times 10^{16} \; [m^{-3}] \tag{16}$$

The above relation Eq. (16) can be realized easily, by a weak external magnetic field of the order of 0.02 ~ 0.05 [Tesla]. Lets check this condition for the concrete purpose of using a ferro-fluid like shown in the Figure 7.
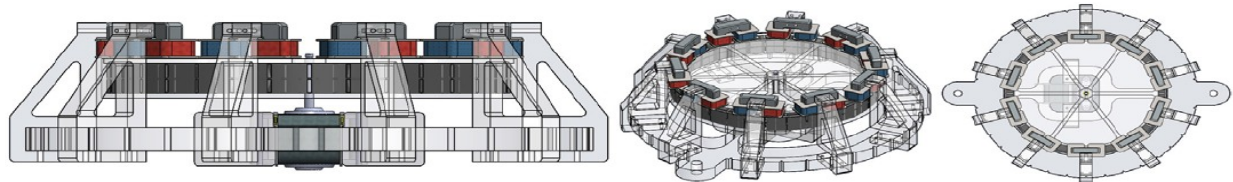

Figure 7 : Front, trimetric and top view of prototype proposal made mainly of acrylic (diameter ~= 28 cm, height ~= 9.2 cm and weight ~= 2.65 Kg) for illustration purposes. The prototype consist of a standard fan induction 220 volt monophasic motor. The motor drives a ferrofluid enclosed in a compartment shown in dark color. Along the path, pairs of poles of electro-magnetic poles are applied to the ferrofluid from above.

The number of solid phase ferro-colloid particles per unit volume is in the order of 1×10^{23} $[m^{-3}]$. A ferro-colloid particle contains a number of ferrite molecules in the order of 2×10^4. The number of 3d-spins in a ferrite molecule is eighteen. From those values, the number of 3d-spins in ferro-colloid particles arranged by external magnetic field per unit volume is in the order of 36×10^{27} $[m^{-3}]$. From Eq. (13), the maximum value of the positive interior energy density E due to magnons comes

$$E \approx 8\pi N_{3d} \times 10^{-7} = 9 \times 10^{22} \; [J \cdot m^{-3}] \tag{17}$$

Since the null weight generator consists of domains applied by external magnetic fields and the domains without external magnetic fields, the mean value of the interior energy density in each generator $\langle E \rangle$ is

$$\langle E \rangle \approx 9 \times 10^{22} \times \frac{sn}{2\pi R} \; \left[J \cdot m^{-3} \right] \tag{18}$$

Here, s is the circumference length of a domain applied by external magnetic field, n is the number of those domains and R is the radius of toroidal tube. The magnetization of ferromagnetic fluid follows the Langevin equation. Since the negative potential energy density of the Earth is in the order of -1×10^{11} $[J \cdot m^{-3}]$ as mentioned on Eq. (14), the cancelling of the Earth gravitational field is very easily achieved.

In fact, the magnon energy per atom of ferrite molecules ε is given by:

$$\varepsilon \approx \frac{9 \times 10^{22} \times \left(\dfrac{sn}{2\pi R} \right)}{2 \times 10^{27} \times 7} = 0.64 \times 10^{-5} \left(\frac{sn}{2\pi R} \right)$$

$$[J / \text{Atom of ferrite}] \tag{19}$$

Here, the number of $2 \times 10^{27} \times 7$ in the denominator is that of atoms of ferrite molecules per unit volume.

In the magnetic fluid, the number of carrier molecules (Kerosene) is larger than 10 times that of ferrite molecules, so that the mean value of magnon energy per atom of all the molecules of magnetic fluid $\dot{\varepsilon}$ is in the order of:

$$\dot{\varepsilon} = \frac{\varepsilon}{10} = 6.4 \times 10^{-7} \left(\frac{sn}{2\pi R} \right) [J / \text{Atom of magnetic fluid}] \tag{20}$$

From the analogy with the gravitational repulsive acceleration on Eq. (6) due to topological effect on spinning non-magnetic materials, the gravitational repulsive acceleration of the clockwise circulating magnetic fluid $\dot{\alpha}$ is given by

$$\dot{\alpha} = \dot{\theta} c R \omega \; \left[m \cdot s^{-2} \right] \tag{21}$$

The transformation coefficient $\dot{\theta}$ is provided from the $\dot{\varepsilon}$ on Eq. (20). The dimension of $\dot{\theta}$ is $[m^{-1}]$ since $\dot{\theta}$ is the transformation coefficient from $\dot{\varepsilon}$ to the repulsive force due to topological effect.

Thus, the acceleration acting on all the atoms constructing the generator due to the topological effect, i.e. $\dot{\alpha}$ is given to be:

$$\dot{\alpha} = \dot{\theta} c R \omega \approx 6.4 \times 10^{-7} \left(\frac{sn}{2\pi R} \right) c R \omega = 1.9 \times 10^2 \, snv \; \left[m \cdot s^{-2} \right] \tag{22}$$

Here, v is the number of circulations of magnetic fluid per second. Therefore, cancelling locally the gravitational force g due to circulating magnetic fluids is easily achieved

by means of the clockwise circulation of magnetic fluids. $\dot{\alpha}$ can be easily controlled by the quantities snv and though the intensity of the external magnetic field.

For the purpose of the prototype shown above, let's make a simple estimation of overall effect based on Eq. (22) with an easily realizable using current technology with a weak exciting magnetic flux density B:

$B = 0.02$ [*Tesla*]

$s = 0.015$ [*m*]

$n = 10$

$\nu = 2$ [*s^{-1}*] $\cong 120$ [*rpm*]

$\eta = 45\%$ [*Global Efficiency*]

We get an upward acceleration lift of approximately

$\dot{\alpha} \cong 0.57 \left[m \cdot s^{-2} \right]$ (~ 0.06 g).

Given that the mass of device is approximately 2.65 Kg, the vertical force generated by lift would be of approximately ~ 1.5 [*N*].

Of course the improvement of efficiency of apparatus can improve the upward thrust by several orders of magnitude by using current technology.

CONFIGURATION OF AN ELECTRICAL POWER GENERATION APPARATUS

The electricity generator apparatus consists of a rectangular pipe of water standing in the vertical direction (Figure 9). On one side of the pipe, the gravitational force is controlled with the help of a series of small magnetic fluid circulation devices as shown in Figure 8.

The vast positive energy created will extend to the nearby pipe volume containing water.

To get an intuitive understanding, by producing a unbalance in the gravitational force of a closed circuit one should expect the fluid inside to develop a flow. The dynamics of fluids have been extensively studied by Landau[53]. As we are considering a closed circuit we should expect pressure and volume to remain constant or to have small oscillation around a stable point of operation.

Pressure relief valves and refrigeration systems can be implemented in parallel in order to control de overall temperature of fluid around a desired operation point.

The kinetic energy of the moving fluid equals its power and its given by the following expression[53]:

$$P_f = K.E.(\phi, \rho, v_m) = \frac{1}{2} \cdot \phi \cdot \rho \cdot v_m{}^2 \quad \left[J \cdot s^{-1} = Watts \right] \qquad (23)$$

Where $\phi [m^3 \cdot s^{-1}]$ is the fluid's flux, $\rho [Kg \cdot m^{-3}]$ is the fluid's mass density and $v_m [m \cdot s^{-1}]$ is the fluid's mean velocity.

The power output will be given by the product of the turbine efficiency and generator efficiency:

$$P_u = \eta_t \times \eta_g \times P_f \text{ [Watts]} \qquad (24)$$

For the purpose of a concrete practical example, its presented here a realistic brief estimation of the amount of electrical power produced based on FEA simulation done in Solidworks 2011 Flow Simulation add-on according to the following specifications:

- Dynamic viscosity of water: $\eta = 0.001$ [$Kg \cdot m^{-1} \cdot s^{-1}$]
- Diameter of the pipe: $D = 0.117$ [*m*]
- Height of the linear section of rectangular pipe structure: $h = 2$ [*m*]
- Density of water per unit volume at 20°C: $\rho_a = 998.2$ [$Kg \cdot m^{-3}$]
- Length of bottom section of pipe structure: $\Delta X = 4$ [*m*]
- Efficiency of the turbine: $\eta_t = 15\%$
- Efficiency of the generator: $\eta_g = 45\%$
- Gravity value in controlled region: $g_l = 0$ [$m \cdot s^{-2}$]

With these specifications it follows:

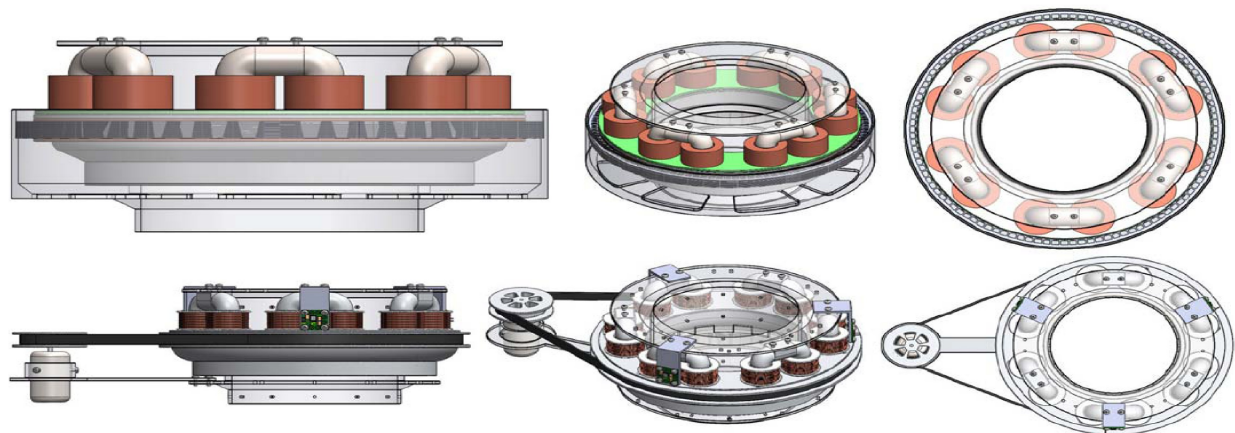- Area of cross section: $A \cong 0.01075$ [m^2]

Figure 8 : Illustration of the gravitational control prototypes to be used in electrical power generation apparatus. Each row consists of front, trimetric and top view of device. On top row a induction type of rotation device is presented (smoother rotation) and on bottom row an external drive version is shown (more affordable version). In both versions a pair of magnetic poles is applied in the vertical direction on the rotating fluid with B in the order of 0.02 to 0.03[T]. In the lower version accelerometers ADXL203 (High performance, single-axis accelerometer on a single IC chip onto a LLC small package from Analog Devices) are projected to be used to monitor the different accelerations real values in each pair of poles.
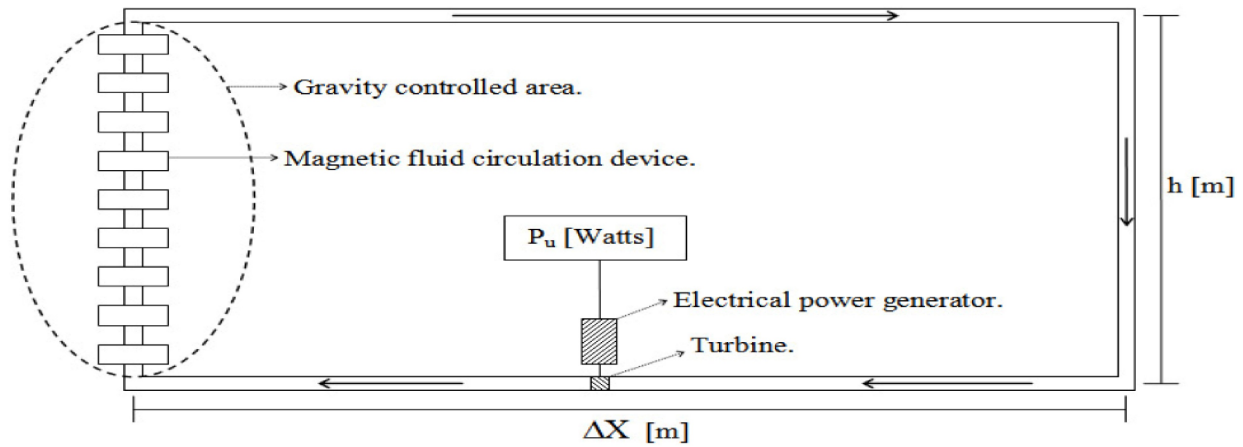
Figure 9 : Illustration of the rectangular pipe structure for electrical power generation. The gravity controlled area consists of a series of magnetic fluid circulation devices as show in figure 8. Arrows show the fluid circulation path.

- Volume of section subjected to standard g: $V = 0.0215$ [m^3]
- Mass of fluid subjected to standard g: $M_{fg} = \rho \cdot V \cong 21.464$ [Kg]
- Propulsion force of fluid: $F_{fg} = M_{fg} \cdot g \cong 210.35$ [N]

One should expect in such a system, constituted by a fluid in a closed circuit driven by constant acceleration that the limit flux velocity be governed by the shear tress force and temperature due to friction.

A boundary condition of real wall was imposed on all areas of fluid circulation and cavitation of fluid was not used in the simulation in order to simplify the calculation and reduce the total time of FEA analysis.

Given that Solidworks 2011 FEA analysis does not allow to specify small regions of the computational domain with different values of gravity, the study was divided in two phases:

1st Phase

A small cross section cut was made in the circuit in order to compute the shear force in function of the fluid mean velocity with the internal circuit clear:

2nd Phase

A boundary condition of static pressure was created in the model in order to calculate the temperature change in function of mean velocity of fluid:

From the results of FEA analysis we may conclude that a velocity of 50 [$m \cdot s^{-1}$] should give a goo operating point. This is equivalent to a flow of □ 0.5 [$m^3 \cdot s^{-1}$]. From the temperature graphic we may infer that the fluid alone circulating in the circuit will not give a big contribution to temperature. But it should be expected that turbine operation can bring heat from the generator. So the temperature control of the system can be achieved with proper refrigerating project on the circuit.

In this case, water with low viscosity and good heat transfer can serve easily as to pump heat out of the system during normal operation.

In addition, for the previous calculations a small turbine example with three blades was created in order to predict the energy loss of fluid at the maximum velocity of
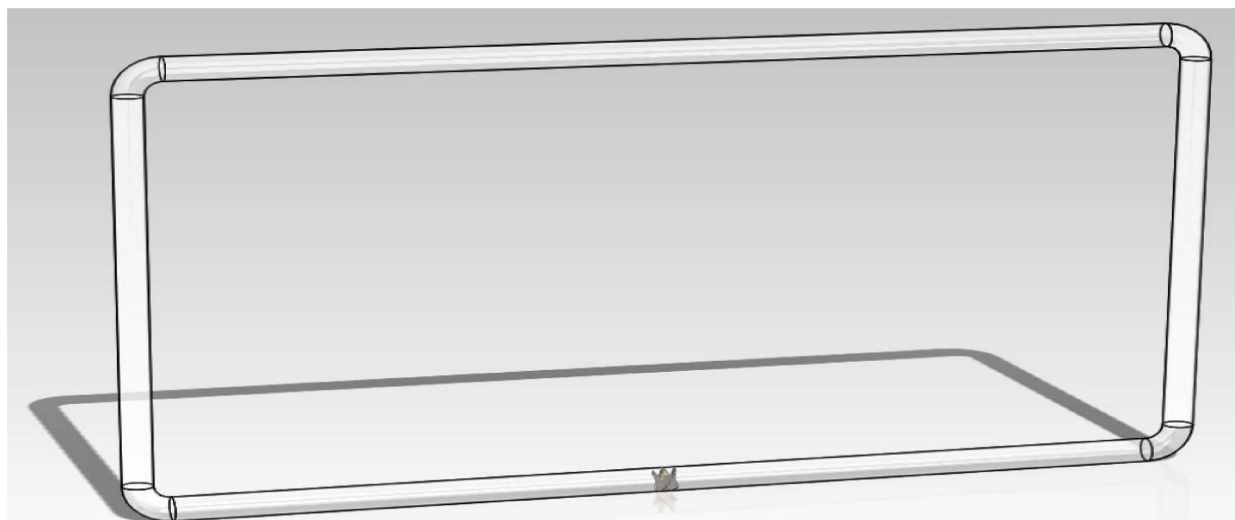

Figure 10 : Picture of model used for FEA flow analysis in solidworks 2011 flow simulation.
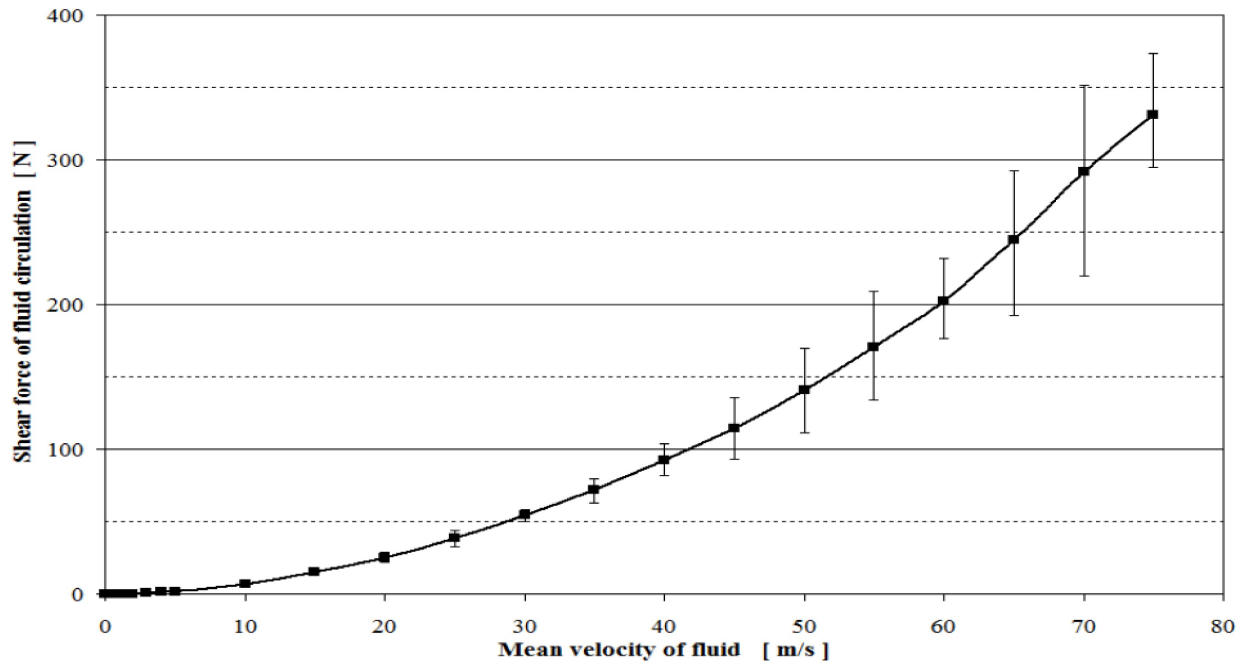
Figure 11 : Shear force of fluid [N] vs mean velocity of fluid [m · s⁻¹] as result of FEA analysis.

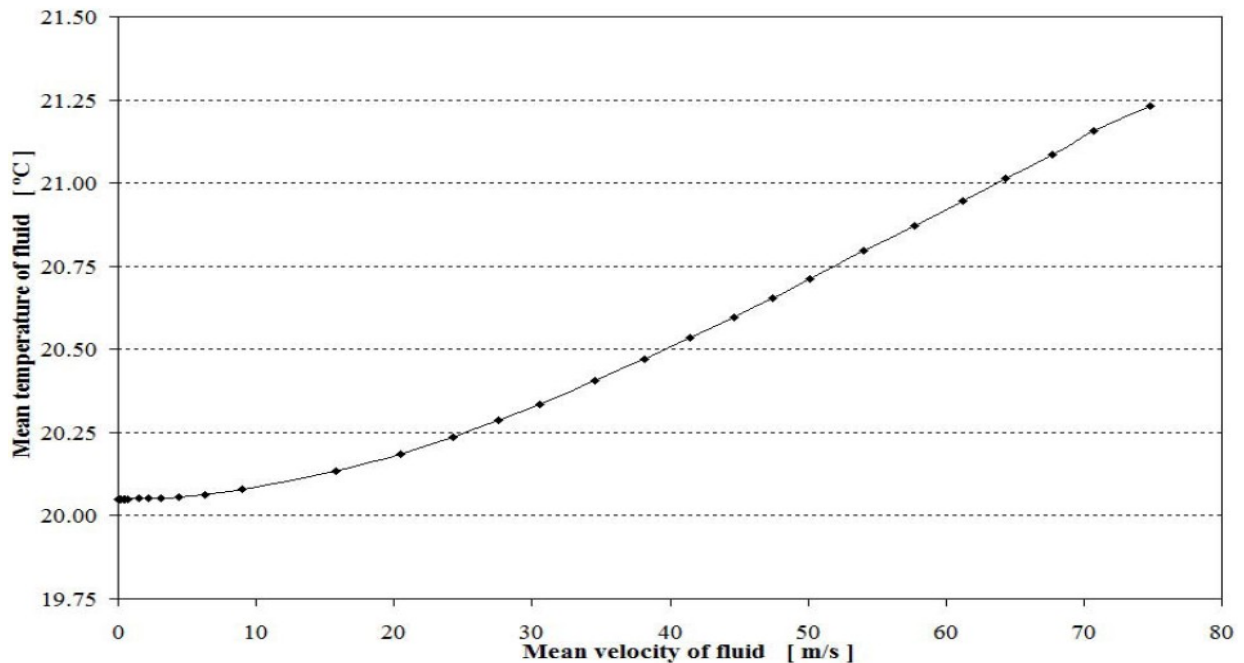**Figure 12 : Mean temperature of fluid [°C] vs mean velocity of fluid [m · s⁻¹] as a result of FEA analysis.**

Figure 13 : Picture of simple turbine fan modeling in flow analysis for simple testing purposes.

75 [m · s⁻¹]. The result of FEA analysis indicated a final mean velocity of fluid in the order of ☐ 50 [m · s⁻¹] which implies a loss of 33% for the same initial conditions.

The inclusion of a turbine and generator can reduce the overall fluid velocity by an amount that depends on the project specification. We will then consider for our electrical power calculation a conservative mean fluid velocity in the order of 40 [m · s⁻¹].

Taking into account the FEA analysis we can then calculate the power of fluid:

$$P_f = \frac{1}{2} \cdot \phi \cdot \rho \cdot v_m^2 \approx 340 \times 10^3 \, [Watts]$$

The final estimated useful output power comes:

$P_u = 0.15 \times 0.45 \times 340 \times 10^3 \approx 23 \times 10^3 \left[Watts\right] = 23 \left[KWatts\right]$

A device producing this level of output power can easily supply electricity up to three small houses on a constant production rate. The remaining useful power can be sold to the energy grid.

Considering the current price of 0.13€ per Kilowatt-hour that is paid today in Portugal to home producers of energy to the energy grid this could bring financial benefits to the home user a mean monthly income in the order of 2000€.

ELECTRICAL VEHICLE DESIGN FOR AERIAL TRANSPORT

The current literature covers extensively the innumerous technological perspectives as to control gravity and achieve propulsion other than the presented technological breakthrough in this article[56-59].

For the purpose of simple illustration of technological application, we present here a possible design of aerial vehicle using the above described topological effect.

Other applications using the same principle can be used to build floating platforms that can continuously make surveillance of a country's administrative territory as well as floating research platforms to explore maritime underwater resources offshore with autonomous underwater vehicles in an economical way as well as a cheap and fast mean to deploy resources in regions where adverse weather conditions makes other means of transport not suitable like Antarctica scientific research stations as well as practical means to offshore rescue missions.

De Rham cohomology allows the local generation of a scalar positive gravitational potential Φ (the point refers to a local scalar repulsive potential generation or anti-gravitational scalar potential artificially generated). To achieve propulsion in the vicinity of a celestial body, we can use one of two principles:

- Controlling the gradient of the gravitational potential

$\Phi_t = \Phi + \dot{\Phi} : \vec{F}_{xyz} = \left(-\dfrac{\partial \Phi_t}{\partial x}, -\dfrac{\partial \Phi_t}{\partial y}, -\dfrac{\partial \Phi_t}{\partial z} \right) \left[N\right]$

- Prompt on/off control based on pressure thrust[48]:

$\vec{F} = m \cdot \sqrt{-g_{00}} \, c^2 \displaystyle\int_a^b R^{00}(r) \, dr \quad \left[N\right]$

The first method is most appropriate for domestic transport without the need to leave the celestial body.

The second method is more universal and allows operation in cosmic space as well as in the atmosphere of a celestial body.

Starting with the design of an commercial vehicle in the European market (Audi TT), we have designed a simple model for illustration purposes having in mind the first thrust option through the control of the gradient. The capacity of vehicle was extended to six people.

We have created three points of support and did not care too much about aerodynamics of atmosphere as we consider that the effect can easily extend to the nearby region of craft and therefore influence also the atmosphere surrounding the craft.

In the front we have navigation (Nav) control electronic equipment consisting of Global Positioning System (GPS) and on board computer as well as batteries for electrical supply.

The two front seats take control of the vehicle through navigation panels, and in the back we have space for luggage.
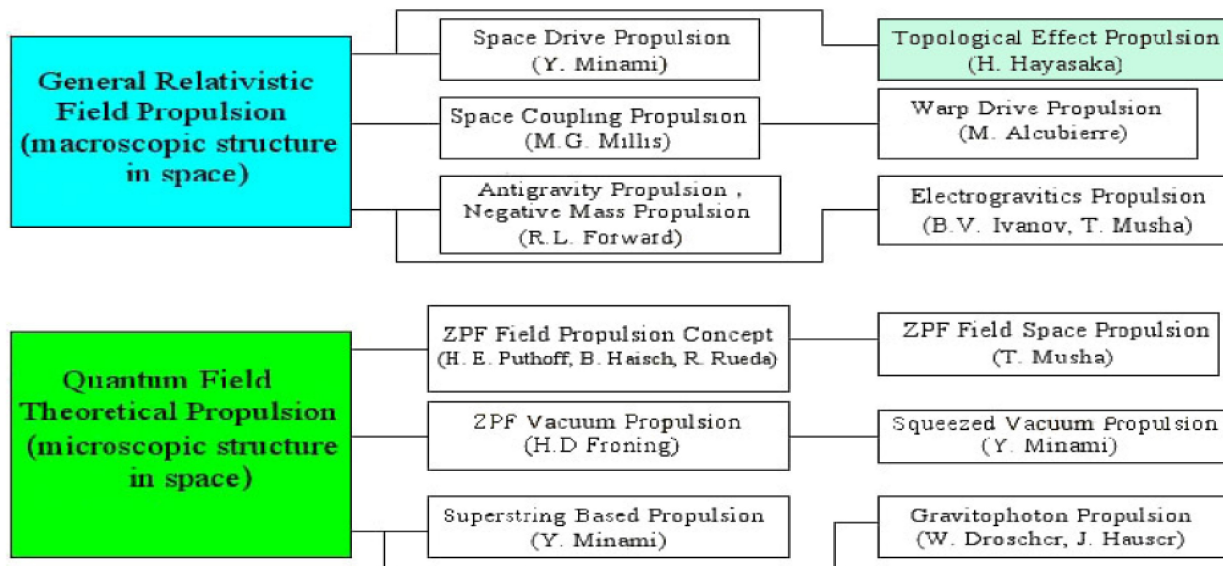

Figure 14 : Diagram of current promising propulsion technologies[55]. Highlighted in light blue is de Rham cohomology theory technological breakthrough described in this paper.
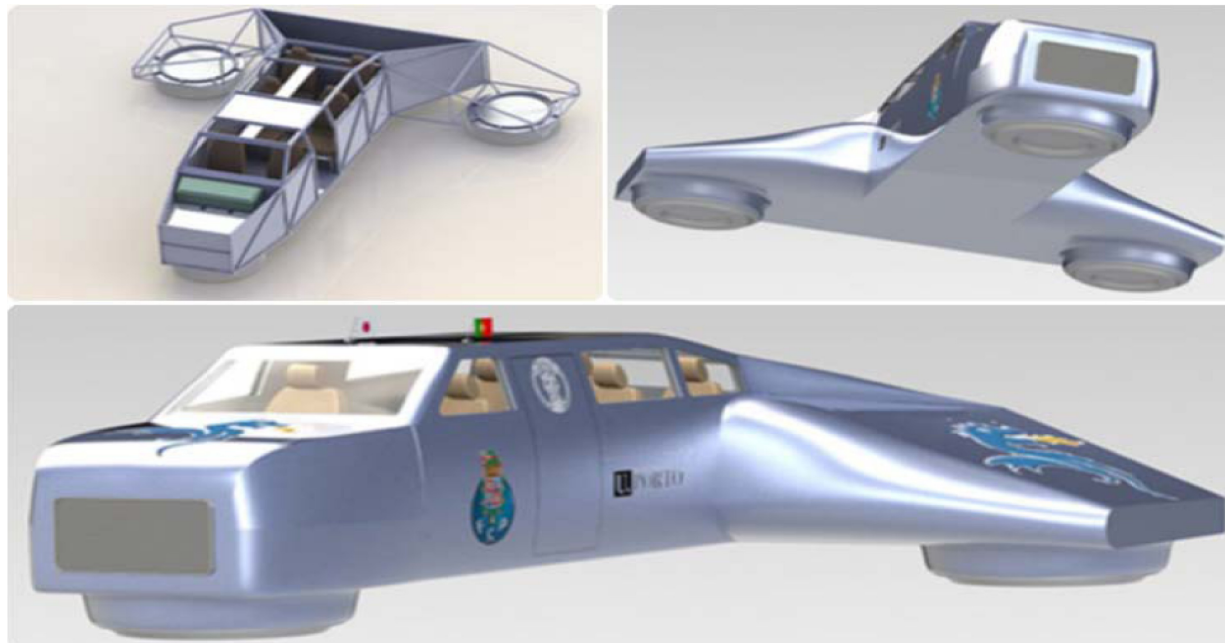
Figure 15 : Concept flying electrical vehicle. Top left: structural illustration with NAV, electronics and batteries. Top Right: view of the three propulsion devices based on de Rham cohomology. Bottom: Front view of vehicle.

APPENDIX I

Summary of aether drift experiments measuring Earth's velocity in absolute space

Authors, (1st publication date)	Epoch	RA	δ	l	γ	$v\,[Km \cdot s^{-1}]$	Type of experiment
David Miller, (1933).	1925-26	4h54m	-70d33m	282d	-35.2d	208	Interferometer, continuous light
K. Illingworth – analyzed by R. Cahill & Kitto, (2003).	1927					369±123	Interferometer, continuous light
Stefan Marinov, (1983).	1973	Earth abs. velocity along instrument axis 130±100					Rotating mirrors, chopped light
Stefan Marinov, (1980).	1975-76	13h23m±20m	-23±4d	313d	38.9d	303±20	Interferometer, rotating mirrors, chopped light
Muller et al.	1976	Velocity towards Leo ~400					CMB
G. Smoot et al., (1977).	1977	11±0.6d	6±10d	245±15d	54±10d	390±60	CMB
Wilkinson and Corey	1978	12h±1h	-21d±21d	288d	40d	320±80	CMB
C. Monstein and J. Wesley, (1996).	1978-96	8.7d±3.5m	-1.1d±10d	227.9d	24.3	359±180	Muon flux anisotropy
Stefan Marinov, (1995).	1984	12.5h±1h	-24d±7d	397.5d	38.4	362±40	Coupled shutters, chopped light
E. Silvertooth, (1986).						378	Rotating mirrors, chopped light
M. Consoli et al., (2006).		202d	-44d	309d	18d	276±71	Analysis of rotating optical resonators

Legend: Equatorial coordinates: RA – Right ascension δ - Declination; Galactic Coordinates: l– Longitude γ - Latitude; – Measured Earth's velocity in absolute space

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NOMENCLATURE

English

c	:	Velocity of light 3×10^8 [$m \cdot s^{-1}$]
r	:	Radius of spinning of rotating object and Distance to the center of the pipe [m]
f	:	Gravitational force [N]
R	:	Clockwise direction, Radius of Toroidal tube and Radius of pipe [m]
L	:	Counter-clockwise direction
M	:	Magnetization [*Tesla*]
H	:	Exchange interaction function [J]
E	:	Interior energy density [$J \cdot m^{-3}$]
N, N_{3d}	:	Number of spins per unit volume [m^{-3}] (number of spins being almost arranged along external magnetic field per unit volume)
$\langle E \rangle$	:	Mean value of the interior energy density [$J \cdot m^{-3}$]
n	:	Number of the domains applied by external magnetic field
U	:	Potential energy density of attractive field [$J \cdot m^{-3}$]
G	:	Gravitational constant 6.672×10^{-11} [$N \cdot m^2 \cdot Kg^{-2}$]
s	:	Circumference length of a domain applied by external magnetic field [m]
f^3	:	$x^3 (=z)$ component gravitational force [N]
A_N, B_N	:	Amplitudes of the Nth mode
N	:	Higher mode
$x^0 (=ct)$	:	Time component of coordinate

Greek subscript

α	:	Gravitational repulsive acceleration due to topological effect of rotating non-magnetic material [$m \cdot s^{-2}$]
$\dot{\alpha}$	:	Gravitational repulsive acceleration due to topological effect of circulating magnetic fluid [$m \cdot s^{-2}$]
θ	:	Transformation coefficient from excited interior energy to gravitational repulsive force for spinning non-magnetic material [m^{-1}]
$\dot{\theta}$	:	Transformation coefficient from magnon energy to gravitational repulsive force for circulating magnetic fluid [m^{-1}]
ω	:	Angular frequency [$rad \cdot s^{-1}$]
Ω, Ω'	:	Integrands
ε	:	Magnon energy per atom in magnetic material [J / Atom of ferrites]
$\dot{\varepsilon}$	:	Magnon energy per atom in magnetic fluid [J / Atom of magnetic fluid]
$d\chi$	:	Exact differential given by Fourier functions.

CONCLUSIONS

A new technological breakthrough based on de Rham cohomology was presented both in the context of the history of the study of the gravitational field, non-systematic and systematic experimental results of weight reduction in the clockwise rotation viewed from above of a spinning gyro made of brass and of the forecast of the practical applications in gravity control, electrical power generation and electric transport vehicle.

The effect was described as the result of the excitation in the clockwise rotation viewed from above of a massless spin-zero boson (Aether boson - ε^0), that mediates weak anti-gravitational interaction in Nature.

The asymmetrical weight reduction effect cannot be explained by the current accepted theories regarding the theoretical description of the weak gravitational field and it was suggested that it can be interpreted directly from Dr Max Abraham non relativistic theory 1912[31-33]. This result is in the same category as the Aharanov-Bohm in the meaning of a gauge effect on a loop group and suggests that nature likes the left-handedness no only in weak interactions but also in weak gravitational scalar interactions[2,8,12]. The twisted fields presented just corresponds to the existence of torsion in space-time in the same category of the λ-transformation discussed by Einstein[46] or the projective transformation of connection discussed by Trautman[47].

A different approach to the Mickelson & Morley experiment was presented that in fact leaded several researches to find coherent results of Earth velocity through a luminiferous ether.

The theoretical background presented here, is not compatible to the existence of a stable fundamental massive spin-zero boson that supports the existence of mass of elementary particles, as announced by CERN and subject of a Nobel prize in 2013. It is very clear to us, that if mass of elementary particles was due to the existence of a massive spin-zero boson, with a bind energy of 125GeV this would lead to the impossibility of a weight reduction in the clockwise rotation of a macroscopic rotor in the order of 13 milligrams. Future developments of research in physics will bring evidence of the specific nature of the decay signals detected at Cern at 125 GeV energy level. At a certain extent this study is more favorable to some predictions of the Goldstone theorem[60,61].

In general the vacuum can be regarded as an ensemble of bosons that behaves like a super fluid[62,63], mass of elementary particles is most probably the result of electromagnetic bind energy with the vacuum.

Lastly we are now in the position to practical implement several small sized prototypes to spread the technology in the University of Porto and bring a new hope with the use of the aether energy to bring technological solutions that can help to overcome the enormous exponential growth of CO_2 in the Earth's atmosphere[59] that threatens

life on Earth as well as promising technological breakthrough to replace the use of nuclear energy in electrical power generation as well as practical applications in all fields of industry (Space exploration, Defense, Logistics, Health and Energy).

ACKNOWLEDGEMENTS

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