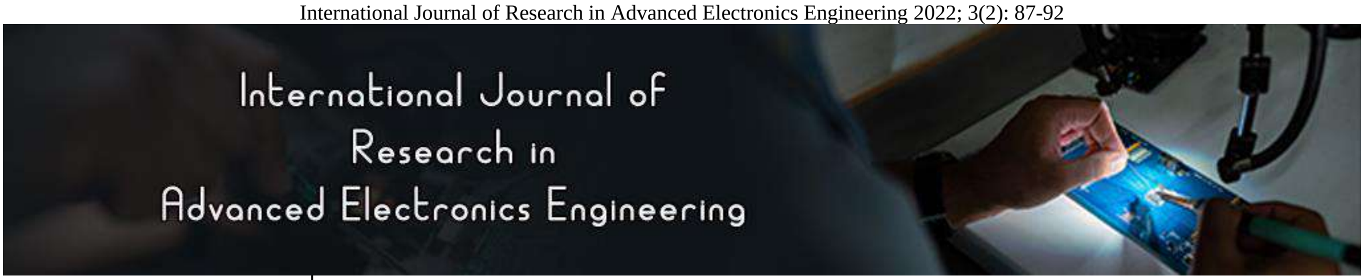

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Electromagnetic plasma reactor: Implicit application of field torsion III: Derived ionic flow

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Abstract
In the electromagnetic plasma has been demonstrated the existence of derived products from electromagnetic plasma as are phonons, fermions, ions, free electrons and protons, magnetic and electric drifts, which produce a ionic force that could be used as propulsion force considering shock waves produced with an electric field on these ions. Likewise, experimentally and considering direct current and voltage in a constant regime, has been detected as ionic wind which carries fermion products to be used in the possible propulsion of the ionic type. This is another way planted for electromagnetic propulsion proposes of previous works. Likewise through of a caption and detection camera, is measured the electromagnetic properties of the ionic flow of the space $\sim II_e(\rho, \boldsymbol{\upsilon})$, derived from the electromagnetic plasma $\sim II_H$, and is proposed an ionic propeller considering the pressure gradients due to electrons and ions concentrated in a little region of the shock waves produced with an electric field. Also is used mean curvature energy to measure and control the ionic flow.

Keywords: Electromagnetic plasma, fermions, fermionic distribution, ion gas, ions, curvature energy

1. Introduction
In before researches we experiment and create an electromagnetic plasma of A. C. We obtain a good response in signal, which we achieve to control with a magnetic field $H(\xi)$, such that:

$$F(\xi) = H(\xi)p(\xi,\tau), \tag{1}$$

Where this principle stills being true in D. C. regime, save considering the pulse $p(\xi,\tau) = \frac{V_0}{2\pi} = cte.$ then its spectra is $V_0\delta(\omega)$, where in the experiments we have considered $V_0 = 5Volts$.
Then we can observe simply that the characteristic of the plasma formed through direct current has a linear behavior or "rectified", and the current has one polarity and no two polarities as in the case of A. C. Then its polarity is constant and no change, which it give to the plasma a define direction.
However, the control of the plasma through magnetic fields still being necessary, because we require establish a close cycle increasing the charge transporters velocity as a fundamental topological characteristic of plasma defined in [1].

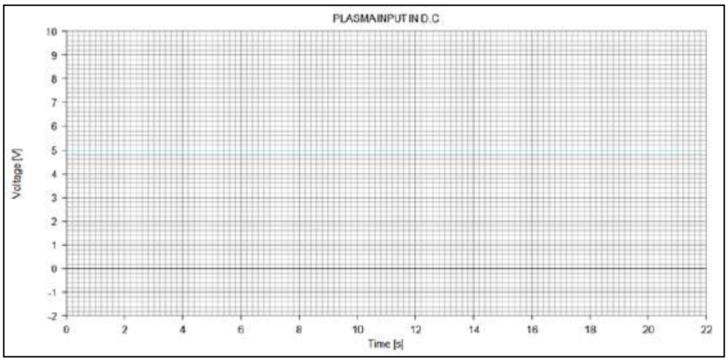

Fig 1: The output voltage $V = 5Volts$, is constant along of all time.

An immediate effect on the high density of electrons in an electromagnetic plasma is the production of many particle species of the fermion class [2]. However we need the macroscopic effects obtained from this fermionic derivation, for macroscopic actions. For it, we consider the MHD framework for an electromagnetic plasma.

1.1. Lemma
In all MHD process

$$\sim II_H(\sigma, \boldsymbol{E}) = \sim II_e(\sigma^2, \boldsymbol{j}), \tag{2}$$

Proof. Indeed, for one side:

$$\sim II_H(\sigma, \boldsymbol{E}) = \sim II_e\left(\sigma, \frac{\boldsymbol{F}}{e}\right) = \sim II_e(\sigma^2, \boldsymbol{j}), \tag{3}$$

Due to that for the charge transporters the electric field complies the equations [1]

$$\boldsymbol{j} = \sigma \boldsymbol{E}, \quad \boldsymbol{\upsilon} = \frac{\sigma}{e^2 n}\boldsymbol{F} = \frac{\sigma \boldsymbol{E}}{en}, \tag{4}$$

Likewise by similarity or congruence [2]:

$$\sim II_e\left(\frac{\sigma^2}{en}, \frac{\sigma}{en}\frac{\boldsymbol{F}}{e}\right) = \sim II_e\left(\frac{ne\sigma^2}{\sigma en}, \boldsymbol{\upsilon}\right) = \sim II_e\left(\sigma, \frac{ne\boldsymbol{\upsilon}}{\sigma}\right) = \sim II_e(\sigma, \boldsymbol{E}) = \sim II_e(\sigma^2, \boldsymbol{j}), \tag{5}$$

For another way, the current complies the congruence:

$$\sim II_e(\sigma^2, \boldsymbol{j}) = \sim II_e(\sigma^2, ne\boldsymbol{\upsilon}) = \sim II_e\left(\frac{ne}{\sigma}\sigma^2, \frac{(ne)^2}{\sigma}\boldsymbol{\upsilon}\right) = \sim II_e\left(ne\sigma, \frac{\boldsymbol{j}ne}{\sigma}\right) = \sim II_e(ne\sigma, ne\boldsymbol{E})) = \sim II_e(\sigma, \boldsymbol{E}), \tag{6}$$

Joining (5) with (6) and applying the third equality axiom we have the identity. ■

Only with the square of the electric conductivity can be possible to obtain sufficient current with charge carriers.
Let $M \subset \sim II_e(\rho, \boldsymbol{\upsilon})$, a space where we will design our camera of ions concentration to realize the propulsion:

$$M = \{\rho | \rho = n_i m_i + n_e m_e\}, \tag{6}$$

This camera consists of the section of negative connection in an ionic propeller whose reactor is an electromagnetic plasma $\sim II_H$, which is transformed in a ionic gas (ionic wind) which has an impulse force (see the figure 2).

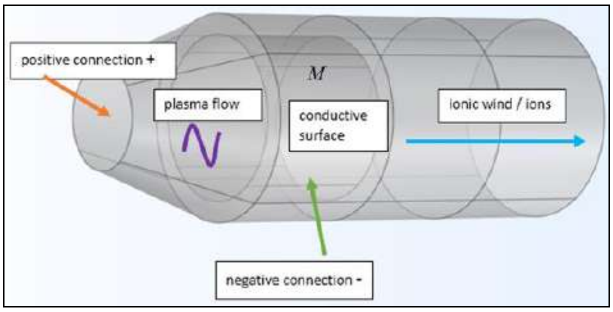

Fig 2. The negative connection section is the ions concentration camera.

Where $\sim II_e(\rho, \boldsymbol{\upsilon})$, is the ternary mixture or ionized gas space conformed of electrons, ions and fermions. This can be formulated as the topological vector homogeneous space:

$$\sim II_e(\rho, \boldsymbol{\upsilon})/M = \left\{\boldsymbol{\upsilon} \middle| \, \boldsymbol{\upsilon} = \frac{1}{\rho_m}(n_i m_i \boldsymbol{\upsilon}_i + n_e m_e \boldsymbol{\upsilon}_e)\right\} \tag{7}$$

Proposition 1.1. If we consider $n_i = n_e$, then the total force of the ionic flow in $\sim II_e/M$, is

$$F_i = -n_i m_i \boldsymbol{g} + q\left(\boldsymbol{E} + \left(\frac{1}{c}\right)\boldsymbol{\upsilon}_i \times \boldsymbol{H}\right), \tag{8}$$

Proof. Will be necessary understand that the macroscopic effect that we are interested is the force from ions, which come from fermions. Likewise, considering for this effect that a particles density $f(\mathbf{r}, \boldsymbol{\upsilon}, t)$, will has a system evolution of Boltzmann distribution type:

$$\frac{\partial f}{\partial t} + \sum_{i=1}^{3}\frac{df}{dx_i}\upsilon_i + \sum_{i=1}^{3}\frac{df}{d\upsilon_i}\frac{F_i}{m} = \left(\frac{\partial f}{\partial t}\right)_{Col}, \tag{9}$$

The to find these macroscopic relations mentioned we multiply the Boltzmann equation by the element field and integrate the possible values of the velocity field υ_i,

$$d\boldsymbol{Q}(\boldsymbol{\upsilon}) = \boldsymbol{Q}(\boldsymbol{\upsilon})d\upsilon_x d\upsilon_y d\upsilon_z, \tag{10}$$

$$\iiint_{-\infty}^{+\infty} \boldsymbol{Q}(\boldsymbol{\upsilon})\frac{\partial f}{\partial t}d\upsilon_x d\upsilon_y d\upsilon_z + \sum_1^3 \boldsymbol{Q}(\boldsymbol{\upsilon})\frac{\partial f}{\partial t}\upsilon_i d\upsilon_x d\upsilon_y d\upsilon_z + \sum_1^3 \iiint_{-\infty}^{+\infty} \boldsymbol{Q}(\boldsymbol{\upsilon})\frac{\partial f}{\partial \upsilon_i}\frac{F_i}{m}d\upsilon_x d\upsilon_y d\upsilon_z = \iiint_{-\infty}^{+\infty} \boldsymbol{Q}(\boldsymbol{\upsilon})\left(\frac{\partial f}{\partial t}\right)_{Col} d\upsilon_x d\upsilon_y d\upsilon_z, (11) \tag{11}$$

If $\boldsymbol{Q} \equiv \boldsymbol{1}$, we obtain the scalar equation of continuity:

$$\frac{\partial n}{\partial t} + grad(n\upsilon) = 0, \tag{12}$$

For contrary, if $\boldsymbol{Q} = m\boldsymbol{\upsilon}$, is obtained the vector equation:

$$\frac{\partial nm\boldsymbol{\upsilon}}{\partial t} + grad(nm\boldsymbol{\upsilon\upsilon}) - n\boldsymbol{F} = \iiint_{-\infty}^{+\infty} m\boldsymbol{\upsilon}\left(\frac{\partial f}{\partial t}\right)_{Col} d\upsilon_x d\upsilon_y d\upsilon_z, \tag{13}$$

Through after transformations the movement quantity equation (9) can take the form:

$$n_i m_i \frac{\partial f}{\partial t} + \boldsymbol{\upsilon}_i grad\, \boldsymbol{\upsilon}_i = n_i q_i\left(\boldsymbol{E} + \frac{1}{c}\boldsymbol{\upsilon}_i \times \boldsymbol{H}\right) - gradP - n_i m_i \boldsymbol{g} + P_{i,e}, \tag{14}$$

If we want the impulse force, we must consider the rarefaction equal to zero, thus the pressures $P_{i,e} = 0$, and $gradP = 0$. Further the total fermionic action is a sum of the actions of the ions that are fermions and electrons which derive fermions too. Then exist only a nature of this force, the fermionic nature. Then the forces from (14) is only (8).
Now with this total force is produced a velocity of the charge carriers interacting with the waves by an asymmetric state of the field, which is guided by the electromagnetism with curvature creating one of their effects that is the torsion on the plasma, holding him captive [2].
However, there are some particles like free electrons, its fermions and leptons, also phonons, which can be used for profit of the proper reactor (feedback) and feeding auxiliary systems of ship for example, or control instrumentation.

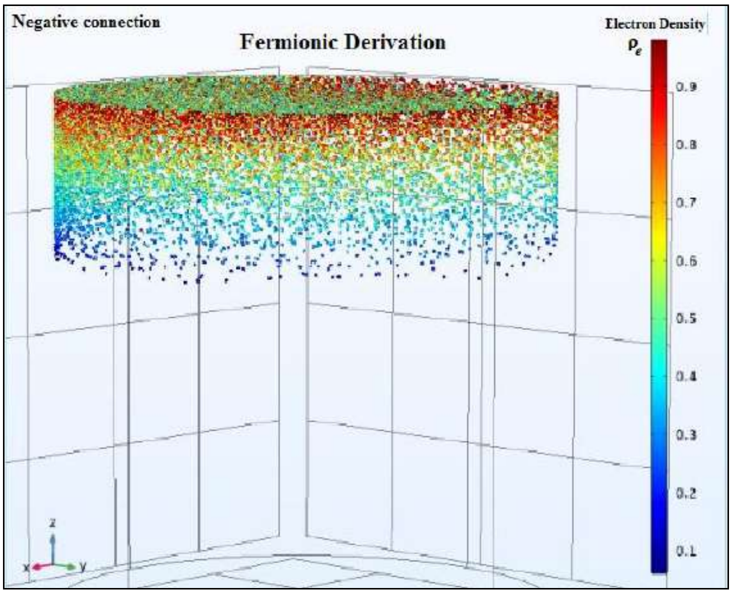

Fig 1: Electron density from the electromagnetic plasma and its derivations in fermions, until to obtain fermions with high velocity (ions) and few free electrons. The red color is a mixture of electrons and photons, yellow stills being mixture where the prevalence is marked by photons. After the photons that are fermions interacts nulling creating bosons. Finally remain ions are fermions with high velocity and few free electrons.

Then applying an electric field on the ions we can produce shock wave of high velocity which are translated in propulsion force.

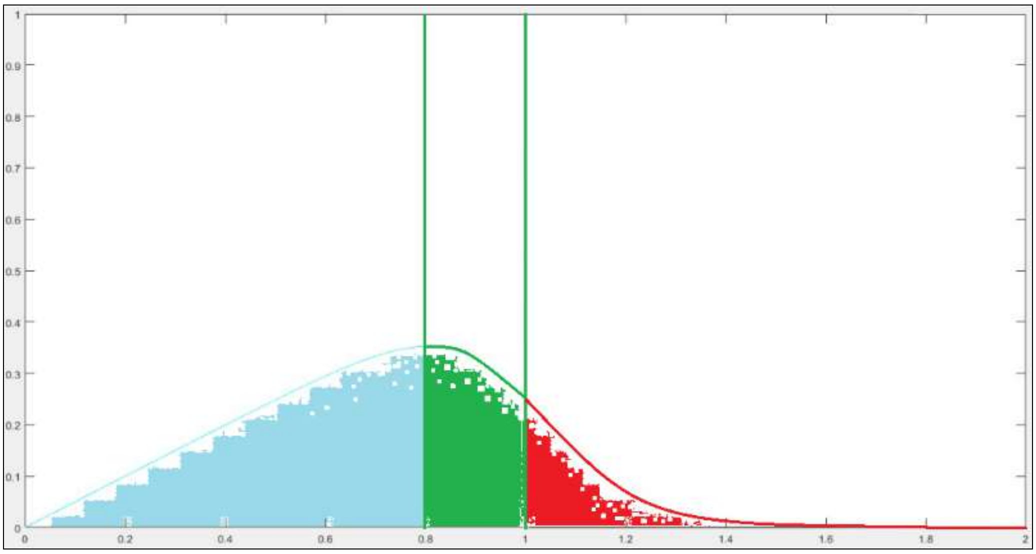

Fig 2: Distribution of electrons-fermions-ions in derivation process from electromagnetic plasma [3, 4].

2. Results

2.1 Ionizing

Considering the mentioned in the section 1, we have the following lemma to analyze from a geometrical point the particle dynamics.

2.2 Lemma

The fermion products derivation has three phases established according to the electromagnetic plasma physics. Proof. Indeed, considering the linearized plasma movement equation given by

$$\rho_m \frac{d\upsilon}{dt} = j \times B - \nabla P - \rho_m \nabla \phi, \quad (15)$$

the plasma physics establishes the following three effects of each partial forces of straight side of (4), including the rarefaction when is apply an electric field on ions [5]. Then the electric force due to the electrons is given by $q\boldsymbol{E},$ also we have the force to ions $q\left(\left(\frac{1}{c}\right)\boldsymbol{v}_i \times \boldsymbol{H}\right),$ with mobility $b = \frac{\sigma}{e^2 n},$ and the total force comes given for all fermions considering the proper of matter particles $-n_i m_i \boldsymbol{g} + q\left(\boldsymbol{E} + \left(\frac{1}{c}\right)\boldsymbol{v}_i \times \boldsymbol{H}\right),$ under pressure due to the constant rarefaction when is applied external electric field to the system [3], that is to say,

$$\nabla P = 0, \quad (16)$$

Now from a point of microscopic view we have a mixture distribution [4] (see figure 4)).

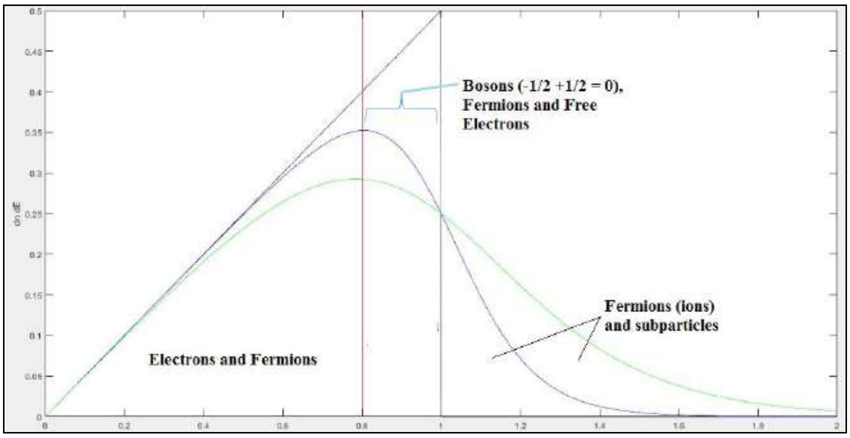

Fig 4. Occupation-number of total Electrons-fermion in three phase distribution $n(r,t)$. The third phase corresponds to the ions that will be pure fermions: as sub-particles as leptons, anions, and etcetera.

Here the hadron transformations helps to understand these three phases. Then we have:

$$Hadrons + e^- \rightarrow e^- + f + b^0, \qquad (17)$$

Which establishes an embedding in an ionized space determined by the mapping [4]

$$\sigma : M \rightarrow {}_{\sim}II_H(\sigma, \mathbf{E})/M\ , \qquad (18)$$

Is the smooth sub manifold embedded smoothly in the ionized space as "laminated". Here to obtain an ionized space is required the sequence

$${}_{\sim}II_H(\sigma, \mathbf{E}) \rightarrow {}_{\sim}II_e(\sigma^2, \mathbf{j}) \rightarrow {}_{\sim}II_e(\rho, \boldsymbol{v})\ , \qquad (19)$$

Which by the lemma I. 1, and due the plasma physics shows three phases in the fermion production (see the figure 4).

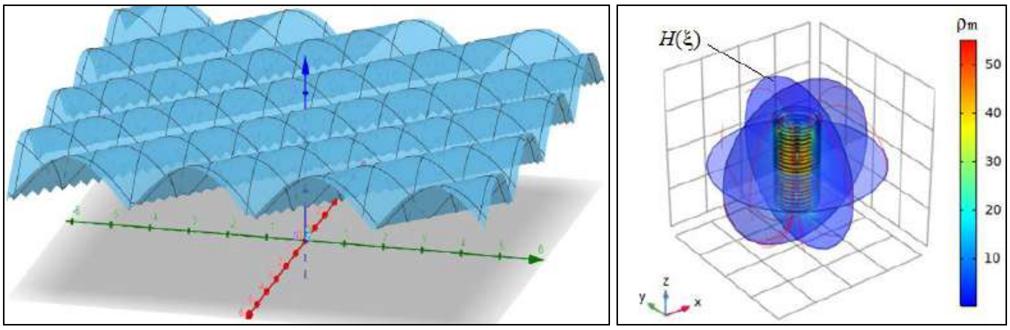

Fig 5. Magnetic field surface under saturation of the current (without fly-back and transistor). We are considered a electron density of range $10^8 \leq \rho_e \leq \frac{10^{12} \mu C}{m^3}$. As the current is a CD-current then is unidirectional, such as is showed in the undulations (the movement is unidirectional). Magnetic field controlling and concentrated the force to the center. Here we are considering in the experiments a magnetic field $H(\xi) = |\sin(x+y)| + 3.5$.

3. Experimental Proofs from Electronic Feeding-Circuit

We consider a feeding of $V_0 = 5Volts$, represented then we have its following spectra in the following theorem.

3.1. Theorem (F. Bulnes). Let $\{\xi\}$, be a system of toroidal coordinates defined to the plasma ${}_{\sim}II_H(\rho, \mathbf{j})$. Let $F(\xi)$, the magnetic force required to centering or guiding of the electromagnetic plasma under DC $-$pulse, and given for:

$$F(\xi) = \frac{1}{2\pi} V_0 H(\xi), \qquad (19)$$

Then a control $u(\xi)$, will come given by the integral-differential equation:

$$u(\xi) = \left\{ \delta(\omega) H(\xi) + \int_{\xi_0}^{\xi_1} H(\tau) \frac{V_0}{2\pi} d\tau + \frac{d}{d\xi} H(\xi) \right\} \qquad (20)$$

Its spectral density of curvature (to control the plasma) will be

$$\kappa(\omega) = \frac{q}{m_i c} \int_{-\infty}^{\infty} H(\xi) e^{-j\omega\xi} d\xi \qquad (21)$$

Remark 1. The spectral density (21) will obtain a modulation of the reactor to signal control of the process and others. Possibly here in the derived product from electromagnetic plasma will can be obtained a special sound due the phonons and fermions.

Due to that ${}_{\sim}II_H(\rho, \mathbf{j})$, is submitted to constant magnetic field then $\frac{d}{d\xi} H(\xi) = 0$, however, is necessary determine along of certain interval $[\xi_0, \xi_1]$, since the plasma ${}_{\sim}II_H$ must conserve the shape of the torus during the application of the field $H(\xi)$.

For other side, we want use the electrons and other products derived of the electromagnetic plasma, yet the few particles that no achieve direct to the center of the electromagnetic plasma.

Remark 2. With respect to the control function we choice a function that keep up the magnetic field to create the current that by the Hall Effect establish a constant potential along the reactor. Remember that this is due to the existence of torsion that create the geometry of the plasma [5]. Likewise, we can choice the control:

We choice a rectifier pulse $p(\xi,\tau) = |sin\xi|,$ and design the control:

$$u(\xi) = \begin{cases} |sin\xi| \,, 0 \le \xi < a \\ 0 \,, \xi = ak, \forall\, k \in \mathbf{Z}^+ \end{cases} \quad (22)$$

From a point of view of electronics, is created a control of current constructing a current dimmer with control of signals and electronic pulse by a semiconductor element given by the transistor 2SD882 (see the figure).

Likewise, the control stays established by the half-wave rectifier which is obtained through corresponding Hartley´s oscillator [8, 9].

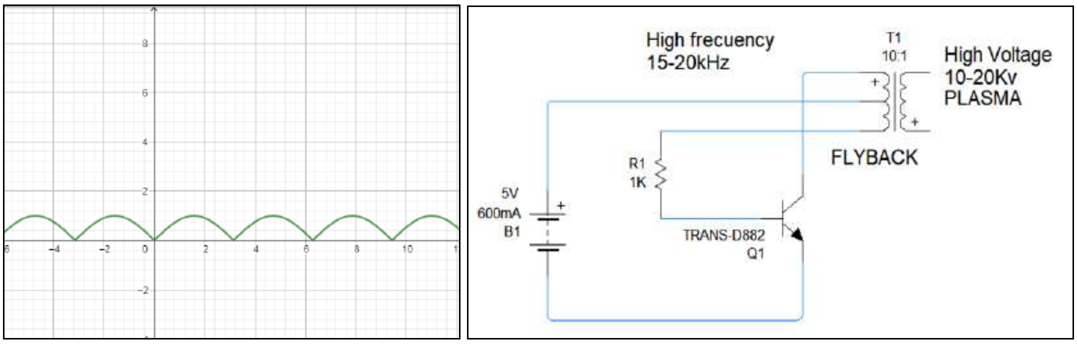

Fig 6: A). Rectifier pulse used in DC. B). Circuit with data of the frequency and the output voltage.

The D882 transistor is connected to the ferrite magnet that goes to the primary coil of the fly-back in order to induce the high voltage, a characteristic of the fly-backs is that they work at high frequencies, so it can be said that the connection of the transistor is an oscillator which produce the half-wave rectifiers.

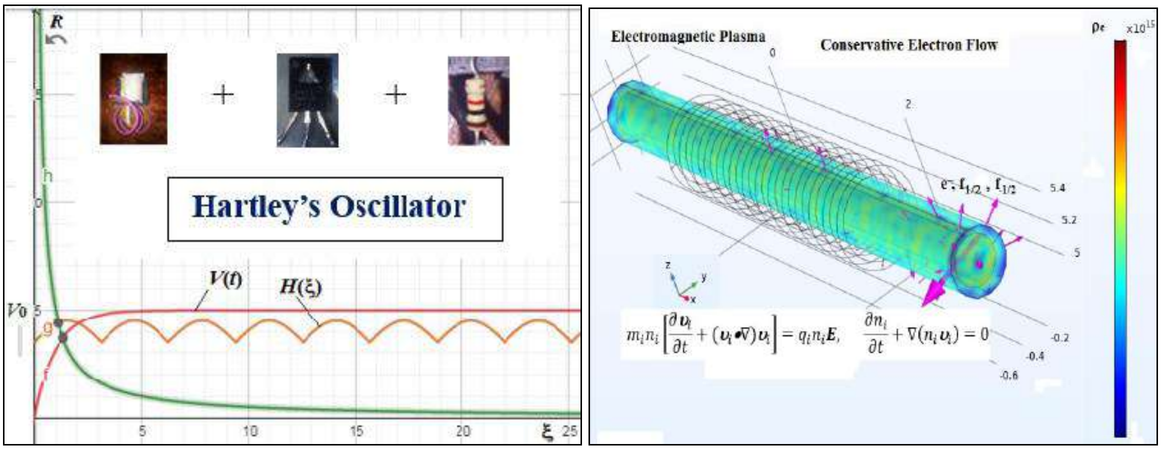

Fig 7: A). Resistive element of $1K\Omega,$ serves to stable the current of the plasma under feed of 5 Volts, which is regulated by the semi-conductor element 2SD882. Then the conversion DC-DC, is realized accord to the magnetic field $(\xi) = |\sin(x+y)| + 3.5$, since the current is induced in the coil that induces voltage in the ferrite imam of the fly-back (see the figure 7). B). Generation of ions in the Gaussian plasma surface $\iiint_{\sim II_e} divjdV = \rho_m.$ this simulation has been realized in Comsol Multi physics.

The curvature energy will be the control of the plasma through of magnetic field $H(\xi).$

Proof. We consider the plasma linearized movement equation given in (15) which expresses the forces (applying the Newton's second law):

$$\boldsymbol{F_{Total}} = \boldsymbol{F_1} + \boldsymbol{F_2} + \boldsymbol{F_3}, \quad (23)$$

Considering our researches in other previous works, we can consider the theorem 4. 1 in [2], where the total force carries a curvature:

$$\kappa = \frac{q}{m_i c}|\boldsymbol{H}|, \quad (24)$$

which can be expressed as function depending of the function $H(\xi).$ Then each component in the right side of (23) has curvature $\frac{q}{m_i c}|\boldsymbol{H}|.$ We consider the remark 1, and the equation for the displacement velocity in any point or particle of the plasma given by the velocity field $\boldsymbol{v_D}$, [2], then we have that the Laplace transform of the corresponding integral equation of Volterra's type is**:**

$$U(p) = \left\{ h(p) + \frac{V_0^2 H}{2\pi l^2}\int_{\xi_1}^{\xi_2} d\tau \right\}. \quad (25)$$

Where $U(p),$ is

$$U\,(p) = \frac{\pi a}{a^2 p^2 + \pi^2} \coth\left(\frac{ap}{2}\right), \tag{26}$$

Then the solution or law is:

$$H(\xi) = |\sin\xi| + \frac{V_0^2}{2\pi l^2} H, \tag{27}$$

Then its spectra is the spectral curvature given using (21) [5]

$$\kappa(\omega) = \frac{q}{m_i c}\left\{\sqrt{2\pi}\left\{\frac{\delta(\omega - a) + \delta(\omega + a)}{2}\right\} - \sqrt{2\pi}\frac{V_0^2}{2\pi l^2} H\delta(\omega)\right\}, \tag{28}$$

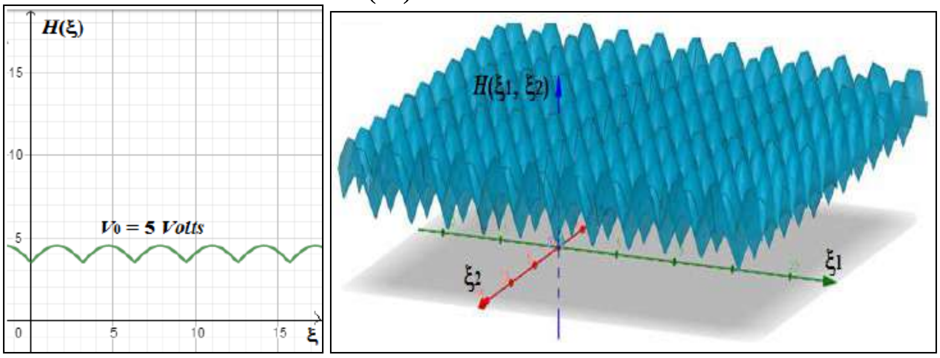

Fig 8: A. Particular solution at 5 Volts feeding. B). 2-Dimensional surface model of the magnetic field to electromagnetic plasma torus.

Realizing the dimensional analysis we have [1, 6, 10, 11]:

$$\kappa(\omega)\left(= \frac{C}{kg\frac{m}{sec}}\frac{T}{Hz} - \frac{C}{kg\frac{m}{sec}}\frac{Volts^2\frac{A}{m}}{m^2}\frac{1}{Hz}\right)\left(= \frac{1}{m} - \frac{1}{m}\right)\left(= \frac{1}{m}\right). \tag{29}$$

5. Conclusions

Now we realize a research on the creation and design of propeller from the electromagnetic plasma now fed through $DC -$current, which has several advantages as its stability, control, high velocity of its charge carriers and power to the construction of a reactor, where could be included other applications in addition a flying ship. We have considered the plasma physics in three fundamental aspects of study; its magnetic managing and control, where are analyzed the congruence's modulo conductivity, the current quality, which talks on the velocity of charge carriers and the fermion derived products that can be used in ionic propulsion as another alternative to a flying ship; considering the plasma as ionized gas or fluid, where the MHD framework is useful. Likewise, to stabilize the current is used a fly-back and from a point of view of electronics, is created a control of current constructing a current dimmer with control of signals and electronic pulse $p(\xi, t)$, by a semiconductor element given by the transistor 2SD882. The dynamical system was analysed obtaining that the control through magnetic field is given by the curvature with a curvature energy $\kappa(\omega)$, given by (28), which arises considering the embedding in an ionized space determined by the mapping $\sigma: M \rightarrow {}_{\sim}II_H(\sigma, E)/M$, which is possible due to the topology of the plasma. This research has contemplated other applications which will be revealed at the time.

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