Elementary electric charge value–a different approach

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Abstract:

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Starting from the similarity between an electric field with a gravitational field, it is demonstrated why (and how) the elementary electrical charge has this value.

It is a parallel theory with that of quantum mechanics and is trying in an approximately-simplistic manner to describe the world of atomic processes.

Keywords: elementary electrical charge; physical field; space-time; inflation – astronomy (General relativity) ; mechanical work; oscillation(vibration); gravity; the constant of the fine structure;

I. Introduction:

In general we find many articles relating to (and about) electrical charge, but nowhere does it say from where it has this value, it's being considered an intrinsic property of elementary particles.

[It will be considered as elementary particles, only those particles that have a "real existence", namely, those which have a bigger life of, let's say, 5 min, - therefore, the electron, the proton and the neutron - the other particles live such a short time, disintegrating almost instantaneously after it's being formed, so that we do not know if it can be considered particles or only "resonances" (oscillations) of determined energy[6]. "Confusion" between the action of an oscillation with the action of a "mass", we find it in Einstein's famous formulas of the energy too, namely $\varepsilon = mc^2$ and $\varepsilon = h\nu$. Describing the energy, they can be considered equal, namely $mc^2 = h\nu$. But we notice that on each side of equality there is a constant and one variable. So, by reducing constants, which are always the same, the variables will remain, that is $m \approx \nu$, which means that the action of a mass, in our case of a one particle, can be confused with the action of a oscillation, and vice versa. It is also known that the proton and the neutron have an internal structure (quarks), but its are considered in all experiments as the standalone particles [1], therefore this is how it will be considerated also in this case.]

II. Basic Ideas:

In this material is starting from the similarity between electric field and the gravitational field, and without contradicting or entering into conflicting with quantum mechanics, it will be explain "why" the elementary electrical charge has this value.

III. Grounds for the study:

Between the gravitational field and the electric field, both with sources at rest, we will find the following:

- **similarities:**

- the mathematical formulas of the two physical fields (of the fields forces) are similars – directly proportional with the masses (respectively with the electrical charges) and inversely proportional to the square of the distances [3];
- the intensities of both fields are described by similar mathematical formulas;
- and I would add, as manifestations of the fields:
  - different masses (under the influence of the unique gravitational field), local, have the same (gravitational) acceleration - it moves identically in the field) [2] [4];
  - different masses (the electron and the proton) have the same electrical charge (as a value) [1];

- electric force, it may seem described by the geometry of space-time (as well as gravity), from Coulomb's formula, as follows:

- we have the description of electric charges from the formula of the fine structure constant:

$$\alpha = \frac{e^2}{2\pi\varepsilon_0 ch} \Rightarrow \alpha = \frac{e^2}{4\pi\varepsilon_0 c\hbar} \Rightarrow e^2 = \alpha 4\pi\varepsilon_0 c\hbar,$$

we replace in Coulomb's formula:

$F_e = \frac{e^2}{4\pi\varepsilon_0 r^2}$ on e^2 and we have $F_e = \frac{4\pi\varepsilon_0 \alpha\hbar c}{4\pi\varepsilon_0 r^2} \Rightarrow F_e = \frac{\alpha\hbar c}{r^2}$ (I),

where:

- α it is the constant of fine structure;
- e it is electric charge;
- π it is a mathematical constant;
- ε_0 is the permittivity in vacuum (or free space);
- c it is the speed of light in vacuum;
- h it is Planck's constant;
- $\hbar$ it is the reduced Planck's constant $\frac{h}{2\pi}$ (also called the Dirac constant);
- F_e it is the electric force, “which occurs between two particles with electric charge”;
- r it is the distance between particles;

From the formula (1), it is observed that what we call electric force, it also exists in the absence of any charge carrier, it (the electric force) seeming more of an "environmental manifestation". As everything happens in an empty space, means that the electric force becomes (according to formula 1) a manifestation of the space-time membrane.

- differences:

- gravitational forces are just attractive [2];

- electric forces can be both, attractive and repulsive [6];

Since the similarities between the two fields are very high, it will apply what is known about the gravitational field [2], and to the electrical field, namely, to give it to the latter, a form which will be described by space-time geometry.

If we were to simplistically interpret the gravitational field (which is just attractive), in the presence of the masses [2], the geometric shape of the space-time curve would be (let's call it positive curvature – downward) as in fig.1.

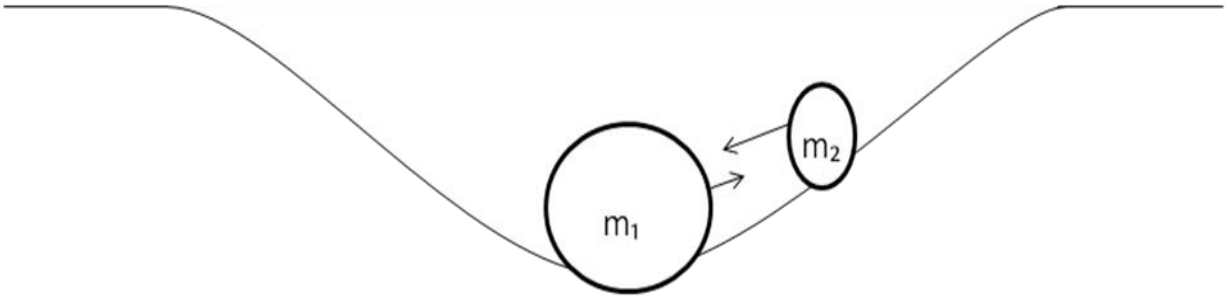

Fig.1: Simplistic interpretation of the gravitational field (which is only attractive) in the presence of the masses.
(Drawing executed by M.A.)

Attempting to give a geometrical shape to the electric field too, we have the model for attractive force, the one from fig.1, but for the repulsive force we should have a negative curvature (let's call it upward) as in fig.2.

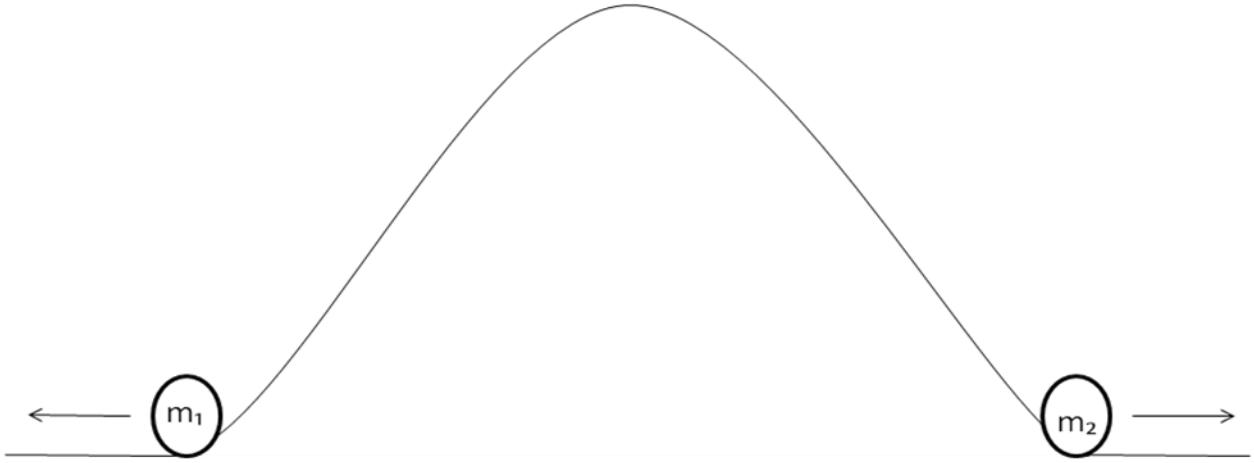

Fig.2: Simplistic interpretation of the electric field, for the repulsive force. We should have a negative curvature (in the presence of the masses).
(Drawing executed by M.A.)

But how would make the space-time membrane to pass from the positive curve (downward) to the negative curvature (upward)? How would "feel" space-time membrane that it has to do with electrical charges of the same kind, to change its curvature? What would be the process of changing the curves?

Something like this is not possible. It can't happen something like this.

Its mean that there is another way to explain the part of the repulsive forces? Is there another phenomenon capable to explaining repulsive force?

Yes, there is a phenomenon that it manifests itself throughout all the Universe and it influence all outerspace bodies. It's about expansion of the Universe [2][3][4], which emerges from a solution found to the equations of Albert Einstein's Theory of General Relativity, is verified by the redshift of galaxies spectrum, detection of background radiation in all regions of the Universe, studying gravitational waves or lenses, and is "measured" by Hubble-Lemaître's law, H_0 constant showing us the rate of expansion, and it shows us that all bodies in the cosmos are moving away from each other.

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(If we ask atomic physicists, if they "believe" in the phenomenon of the expansion of the Universe, all of them will affirmative answer, but none introdu ced the effects of this process into the "atomic world")

It is clear that this expansion of the Universe phenomenon, which influences (and pushes away) massive bodies (outerspace bodies) from Universe, it will influence all elementary particles too. It's not possible that "disturbing" massive bodies, to not influence the elementary particles too.

This phenomenon best explains " fugue" (rejection) of the particles, one from other.

IV. Development of the study:

Trough the expansion of the Universe we understand „the swelling - increases" of space-time [2][3][4] and it can be imagined like a balloon which has a some dots marked on it, and when it's swelling, the points are push it away, one from other [3], without being actualy „ moved"(to support the action of any forces), as in fig.3.

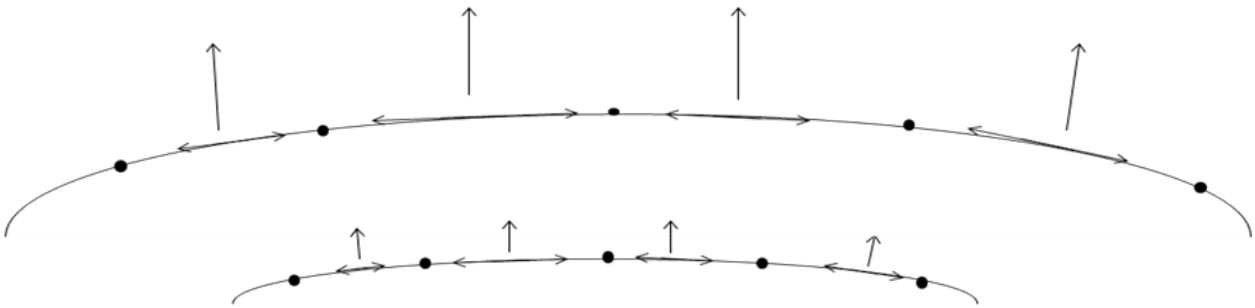

Fig 3: Expansion of the Universe can be imagined like a balloon that has few points drawn on it, and when it swelling, the points is move away, one from another, without that these to be "moved" (without feel the action of some forces) really.
(Drawing executed by M.A.)

This will also happen with elementary particles. They are not dots on the surface, but will be "pulled" by the space-time which is in the expansion process, as in fig.4, and for an external observer it will seem that they are moving away, one from another, indifferent of their mass,as if it will be under the influence of any field, respecting the law of the inverse of the square of the distance.

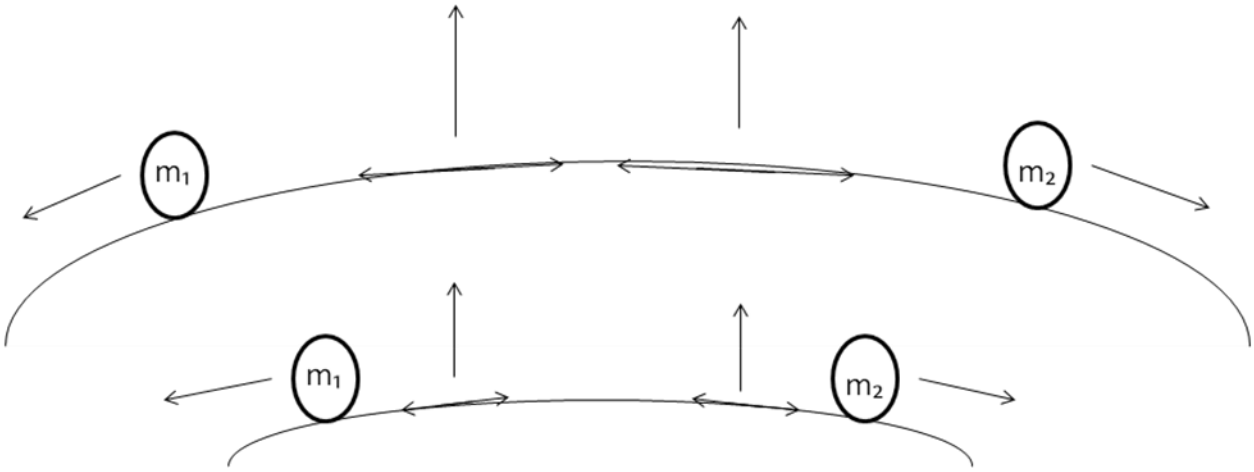

Fig 4: The elementary particles that are "dragged" of space-time which is in the expansion process , and for an external observer it seem that its moving away, one from another, as if under the influence of an physical field.
(Drawing executed by M.A.)

Now we have the explanation for the phenomenon of fugue (rejection) of the atomic particles, but in this case we can no longer explain the case of attraction between them.

However, one can notice that there is a limit (let say, a critical mass), from where rejection no longer has effect, but prevail only attraction between particles. The mass of the neutron is this „critical mass", and it is at the limit, between stability and instability.

[Through the critical mass we understand the limit (downward) from where the space-time influences the matter, and from where(upwards) the matter influences the space-time membrane, deforming it. It's like the Brownian movement(thermal agitation movement), see the"effect of colloidal emulsion" (in my case, of the space-time membrane) at the test particles, up to a certain mass (critical mass), but from this upwards mass value, the effect of colloidal emulsion (in my case, of the space-time membrane) it is no longer possible. From the critical mass value up, the curvature of the space-time membrane appears under the action of the mass - the gravitational effect appears.]

V. Completion of the study:

From the ideas presented above, we can draw the following conclusions:

- the attraction of particles is the bending of space-time in"downward";

- rejection is constituted by "pulling" the particles by the space-time surface, in the expansion process;

- we have a critical mass, between stability and instability, from where the down-bending process of space-time it may oppose to the inflation process;

Based on these conclusions, we can deduce that when two (or more) masses, which insummeded have at least critical mass, are influenced to approaching, „resistance to deformation of the space-time membrane" it will break locally, and it will curve "downward". Thus, the bending of the space-time membrane it will keep the masses together ("rolling one to another"), opposing to the pulls of the masses, by the expansion process of the surface, as in fig.5

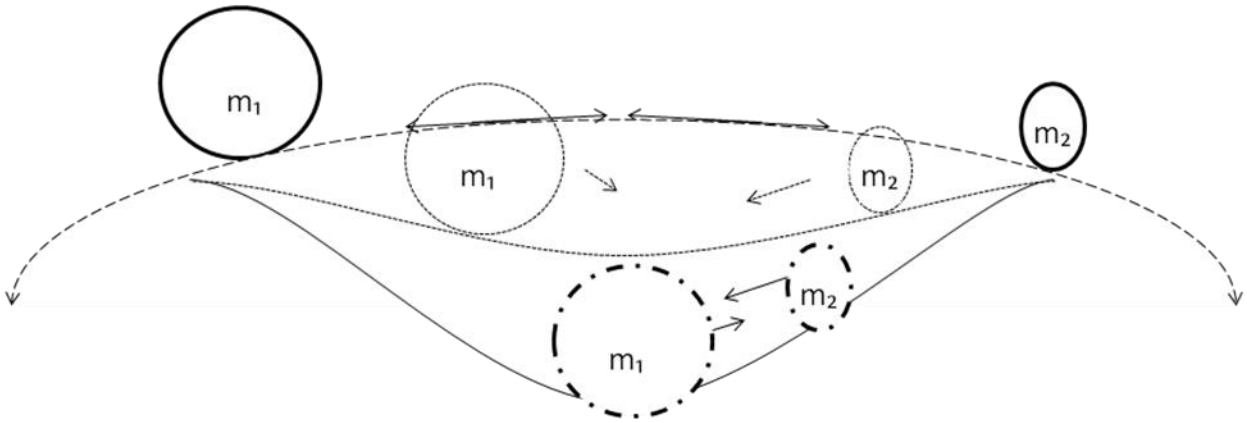

Fig.5: Breaking superficial tension of „space-time menbrane", opposing so to the pulling of the masses, by the expansion process of the surface.
(Drawing executed by M.A.)

But it is noticeable that when the space-time membrane it's bending, it's doing a mechanical work, transmitting a vibration (an oscillation)„ε" to the whole surface, fig. 6. These oscillations behave like a particle [6], generating what we call neutrino.

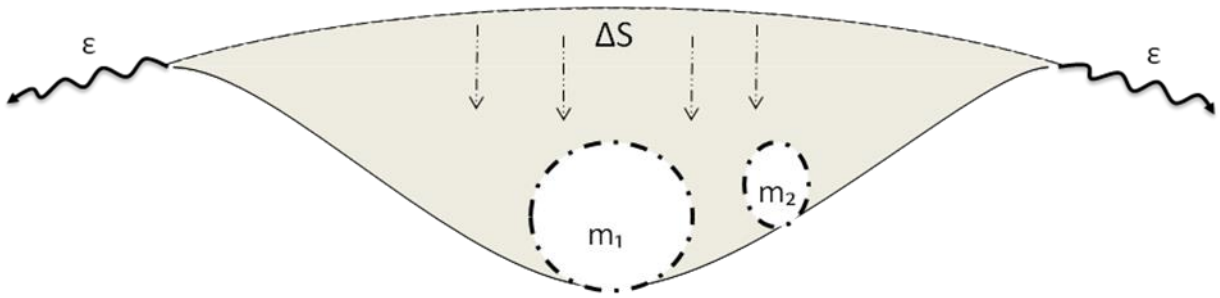

Fig.6: Mechanical work done by the space-time membrane and the transmission of oscillation in the whole surface.
(Drawing executed by M.A.)

But, as I said, this critical mass (obtained from the summation of the masses) is at the limit of stability (in a state of unstable equilibrium) and any smal perturbation (and under the influence of the expansion of the Universe process) it will disintegrate into the component parts, and the space-time membrane will once again perform a mechanical work, releasing another neutrino,as in fig. 7.

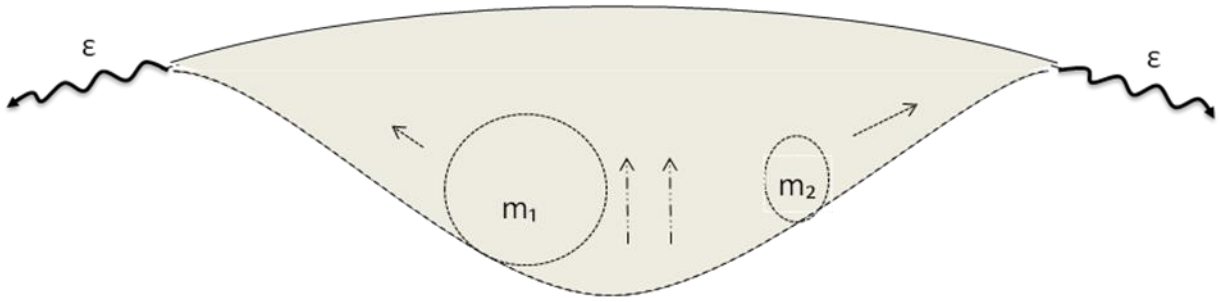

Fig.7: Disintegration of critical mass and the release of another neutrino.
(Drawing executed by M.A.)

VI. The advantages of this interpretation:

This interpretation doesn't get in conflict with quantum mechanics and has the following advantages:

a) shows that everything that we call electrical charge is actually the action of the expansion of the Universe process on the particles with a lower mass than the critical mass. The expansion of the Universe process gives the quantitative value of electrical charges, respecting the law of the inverse of the square of the distance;

b) because the "electrical charge property" is actually a property (a process) [8] of the space-time, the problem of infinite masses and of electrical charges of the electron disappears [5];

c) neutrinos being a very, very, very small oscillation of space-time(compared with the gravitational waves), it influences very hardly the materia (small energy), making-them very difficult to be detected [1][5][6]. At the same time, being an oscillation whose action can be considered (confuse with) the action of a particle [6], it's easy to understand why it can change from one type to another (metamorphosis of neutrinos), and why it can be mistaken with its own antiparticle;

VII. Quantitative representation of the study:

Although is are phenomena that it manifest at different scales of the Universe, it is observed that the electric force and the expansion of the Universe have some similitude's (similarity in shape), all we need to do is find them, so that, by physical analogy, knowing mathematical quantities of a phenomenon, to be able to find them in the other phenomenon [9].

To succeed in the analogies, we must consider the following:

a) **simplification conditions:**

- the analogies are valid only locally (limited in time and space, property does not change, there are no external deformations or influences);

- although in the expansion of the universe there is talk of the displacement with a certain speed of celestial objects relative to the Earth fig.8(a), in reality it is not so. In fact, they both move away, with equal speed, compared to an imaginary point halfway between them. fig.8 (b);

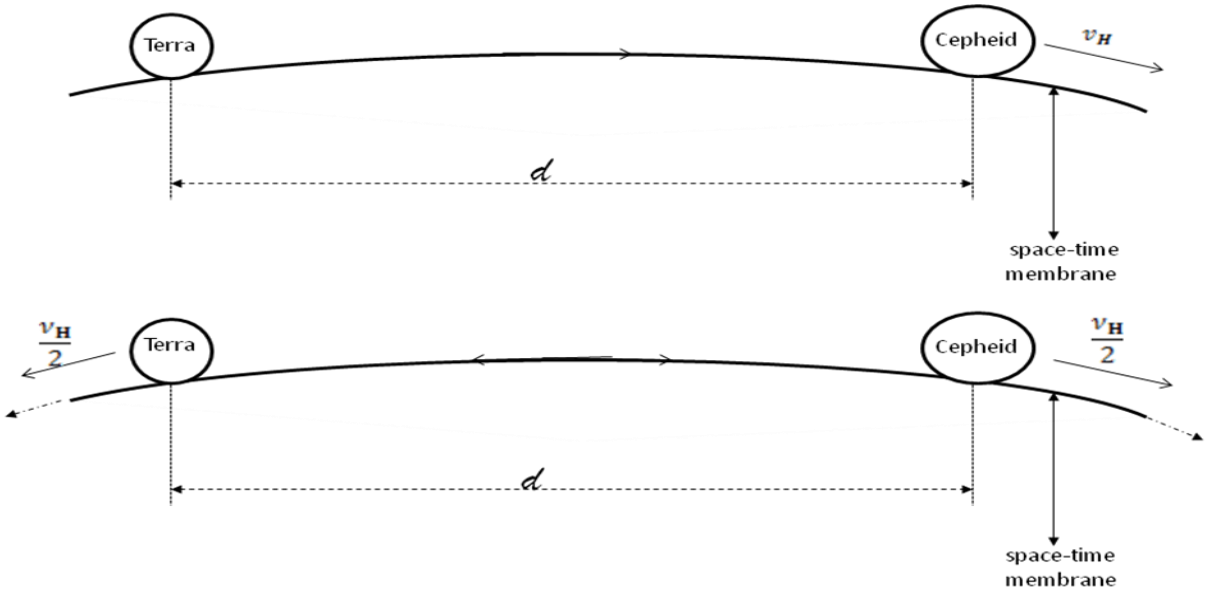

Fig 8: The simplistic representation of the expansion of the Universe.
(Drawing executed by M.A.)

- although in Hubble-Lemaître's law (which shows us the expansion rate of the universe) we are talking about the apparent speed of expansion, in reality it is an accelerated movement, because the speed varies with the distance;

- because in my material I always talked about a space-time membrane, it means that we can also talk about elasticity, and the best representation of these "phenomena" (electric force, elastic force and the expansion of the universe) it is an imaginary arc that de-compresses itself, after it has been compressed.

Therefore, between electric force, elastic force and the expansion of the universe (Hubble-Lemaître's law), will be the following analogies:

Electric force	**Elastic force**	**The expansion of the universe**
		
- explains the repulsive force between particles (bodies) of the same kind;	- explains the repulsive force between bodies (between the ends of the compressed arc);	- no any force is specified, but there is talk of bodies moving away (they can be considered to reject each other);
- decreases with increasing distance between bodies (particles);	- decreases with increasing distance between bodies (between the ends of the expanding arc);	- there is no talk of any decrease of force, but the model of the expansion of the Universe is a model of an inflating balloon, therefore the "Law of the inverse of the square" could be applied;
	- F = constant x lengthiness (distance);	- v = constant x distance (lengthiness);

b) **clarification conditions**:

- *analogy electric force - elastic force*:

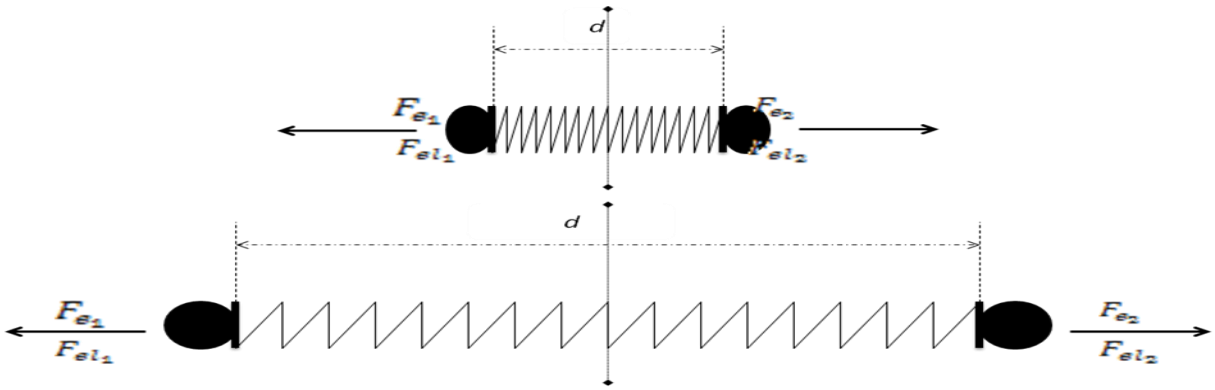

Fig. 9 : Representation of electric and elastic forces, with the help of a arc that decompress.
(Drawing executed by M.A.)

- as can be seen in the representation of fig.9, electric forces F_{e_1} and F_{e_2} are equal, just like in Coulomb's Law, just as the elastic forces F_{el_1} and F_{el_2} are;

- as can be seen from Coulomb's Law, the force felt is the same (depends only on the environment), in the formula not specifying anything about the mass of any particle, the same thing happens with the elastic force, any table will feel the same force (which depends only on the material of the arc).

- the electric force decreases or increases depending on the distance between the electric charges, as (in this case) it happens in the case of elastic force, it varies according to the distance between the ends of the arc;

- although the elastic force is known as a "linear force" it has a formula of the type $F_{el} = k_{el}\, d$ in this case it decreases with increasing distance between the ends of the arc, therefore it is inversely proportional to the distance, and we are not mistaken if we write $F_{el} = \frac{k_{el}}{d}$, where:

- d is the distance between the ends of the arc;
- k_{el} is the elastic constant, which is specific to the arc material;
- F_{el} is the elastic force.

- indeed the elastic force of the arc is $F_{el} = \frac{k_{el}}{d}$, but at each end of the arc we meet equal forces $F_{el_1} = F_{el_2}$, and they represent only half the force of the arc, that is $F_{el_1} = F_{el_2} = \frac{F_{el}}{2} = \frac{k_{el}}{2d}$.

- as seen in fig.9, $F_{e_1} = F_{e_2}$, can be confused with $F_{el_1} = F_{el_2}$, this means that $F_{e_1} \sim F_{el_1}$ or $F_{e_2} \sim F_{el_2}$, and how $F_{e_1} = F_{e_2} = \frac{e^2}{4\pi\varepsilon_0}\frac{1}{r^2} = \alpha\hbar c\,\frac{1}{r^2}$, also $F_{el_1} = F_{el_2} = k_{el}\frac{1}{2d}$, wherefrom

$\Rightarrow \frac{e^2}{4\pi\varepsilon_0}\frac{1}{r^2} = \alpha\hbar c\,\frac{1}{r^2} = k_{el}\frac{1}{2d}$, and we will have the following conclusions:

■ r and d, describe distances between particles and the ends of the arc, respectively, therefore, we can say that the forces act along the "distance line" that unites them, then $r \sim d$;

■ if we eliminate distances, we have

$$k_{el} = \alpha\hbar c = \frac{e^2}{4\pi\varepsilon_0} \qquad \text{(II)}$$

, which means αħc and $\frac{e^2}{4\pi\varepsilon_0}$ can be considered as constants of the arc , ie arc elasticity constant;

■ I have previously specified that by the analogy of the expanding arc, in fact, we "replaced" the space-time membrane with its properties, which leads us to the conclusion that (in based on the previous conclusion) the elasticity constant of the arc k_{el}(and its equalities), it actually becomes the constant of space-time;

■ how k_{el} is a material property, this means that it is a "property" of space-time, and equalities k_{el} = αħc = $\frac{e^2}{4\pi\varepsilon_0}$ it turns out that they are properties of space-time.

- the analogy of the elastic force with the expansion of the Universe:

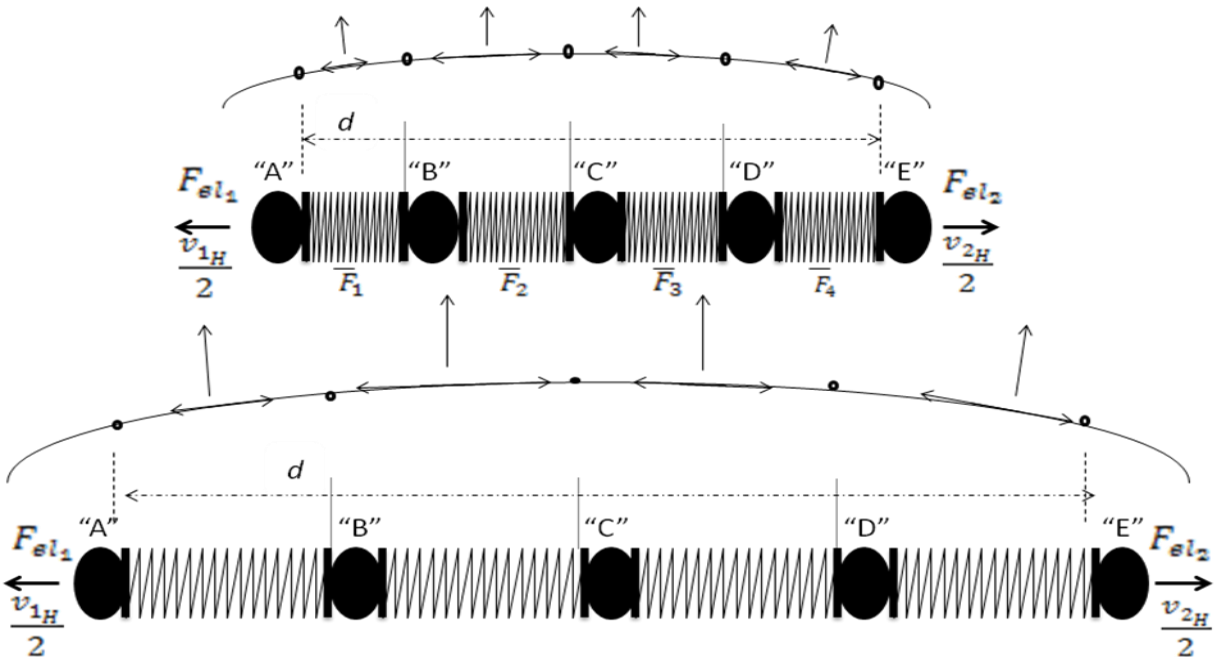

Fig. 10: Representing the expansion of the universe with the help of arcs, and similarity to the expanding space-time membrane(see also fig.3)
(Drawing executed by M.A.)

- although it would seem that an expanding arc cannot "explain" how the celestial bodies move away according to Hubble-Lemaître's law, we notice that more arcs, of the same type (all manifest the same force, under the same conditions), between which are several bodies, as in fig.10, can be a good analogy of the expansion of the universe;

- in this case, we notice that at the ends of the "ensemble" of the arcs (i.e. where the bodies "A" and "E" are), the felt force will actually be the sum of the forces manifested by each arc, meaning $F_{1+}\, F_{2+}\, F_{3+}\, F_4$;

- if we have "n" arcs, then we notice that at the ends of the "ensemble" of arcs, we will have $F_1 + F_2 + F_3 + F_4 \ldots + F_n$, and since the forces are equal, we will have $F_1 + F_2 + F_3 + F_4 \ldots + F_n$ = nF = n $\frac{k_{el}}{2d}$, where "n" is a natural number;

- from this analogy, we have the following conclusions:

■ this analogy explains well the expansion of the universe;

■ the expansion of the universe is described by the "Hubble-Lemaître" constant H_0, and by analogy with elasticity, it turns out that it can also be described by an elastic constant;

■ describing the expansion of the universe with an "ensemble" of arcs, we notice that the expansion becomes a multiple of "n" constants, that is expanding space-time makes it jerky, nonlinear – we can say that the expansion of the universe is quantified.

- ***the analogy of electric force with the expansion of the Universe***:

- the fact that the two "phenomena" (electric force and the expansion of the universe) can be described by analogy with elastic force, it justifies us to say that they are also analogous to each other – the property of transitivity;

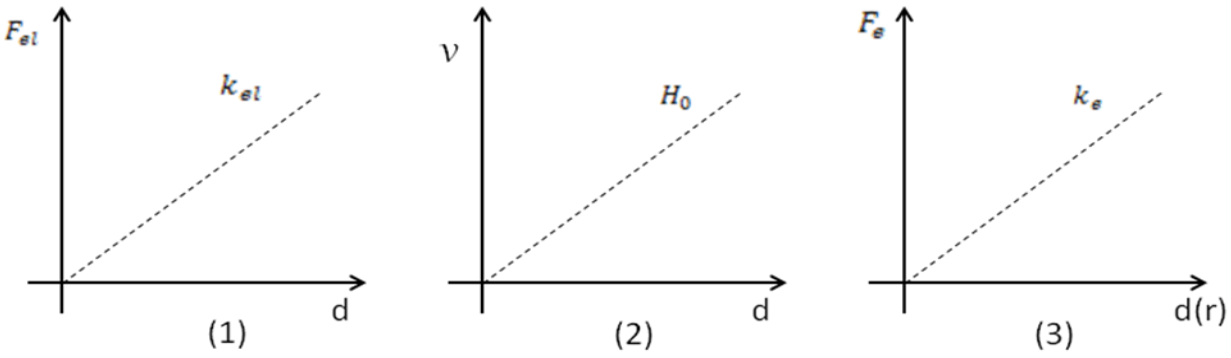

Fig.11 Graphical representation of elastic force, expansion of the universe and electric force

- as can be seen from fig.11, graphical representation of the elastic force (1), Hubble-Lemaître law (2) electric force (3), it is similar, all describing a constant, where:

- F_{el}, is the elastic force;

- d, is the distance;

- k_{el}, is the constant of elasticity (constant of the material);

- v, it is the speed at which celestial bodies are removed according to Hubble-Lemaître's law;

- H_0, este constanta lui Hubble;

- F_e, it is the electric force;

- k_e, is the "constant of electric force", which I considered equal to $\frac{e^2}{4\pi\varepsilon_0}$, and which, due to the permittivity, becomes constant of material;

- from this analogy, we have the following conclusions:

■ this analogy follows from the analogy of the two (electric force and the expansion of the universe), with electric force;

■ the fact that the analogy is valid, can also be seen from the graphic representation of the three “analogies”

■ as these analogies describe a constant, it means that the constants are also "analogous" to each other;

■ as the analogy of the elastic force-expansion of the universe is given by a multiple of "n" elastic constants, and the elastic constant is equal to the electric constant (according to the elastic force-electric force analogy), means that, by the property of transitivity, analogy of the constant expansion of the universe - the constant of electric force, is a multiple of "n", that is H_0~ n($\frac{e^2}{4\pi\varepsilon_0}$);

VIII. Value (mathematical) verification of the analogy of the constant expansion of the universe - constant of electric force:

We have the analogy of constants

$$H_0 = n(\frac{e^2}{4\pi\varepsilon_0}) \qquad \text{(II)}$$

, but we must make (a) its transformation H_0 and (b) to find the value of “n” as follows:

(a)- through the transformation of H_0, it is understood to bring the value to the "standard" meter-second of the Hubble constant, by the rule of three-simple:

- using one of the values used for H_0, that is, of 70 km/s/Mpc- where Mpc means megaparsec and has a value of 3.085778 x 10^{22} meters - and using the three-simple rule, we can find the Hubble constant per meter, as follows: if H_0 arrive at 70 km /s at a distance of one megaparsec, at a distance of one meter will be $H_{0/m}=\frac{H_0}{Mpc}=\frac{7x10^4}{3.085778\ x10^{22}}$ = 2,261143380x10^{-18}m/s/m.

(b) to find out its value "n", we have to calculate the other term in equality, namely

$\frac{e^2}{4\pi\varepsilon_0}=\frac{(1,60217655x10^{-19})^{\ 2}}{4x3,14x8,85418782x\,10^{-12}}$= 2,3070771288996528052149x10^{-29}

How the value of H_0 it is not known precisely, we can consider the values of H_0 and $\frac{e^2}{4\pi\varepsilon_0}$ are equal (differing only in powers), deducem astfel că we deduce thus that n = 10^{11}.

Acum având valoarea de "n", we can find out exactly the value of $H_{0/m}$, in a vacuum, and we have

$H_{0/m}$= n($\frac{e^2}{4\pi\varepsilon_0}$)=$10^{11}\frac{(1,60217655x10^{-19})^{\ 2}}{4x3,14x8,85418782x10^{-12}}$=2,3070771288996528052149x10^{-18}, this is its the value of H_0 at a distance of one meter, ș And so we can find the Hubble constant at a distance of one megaparsec by doing the inverse $H_{0/m}=\frac{H_0}{Mpc}\Rightarrow H_0=H_{0/m}\ x$ Mpc = 71188,96171976428 m/s ≈71,18891 km/s.

Conclusion:

This material shows us that electric charge is actually a "property" (a process) [8] of space-time, and that its value is given by the process of expansion of the Universe, being able to say that the value of the electric charge ***e*** depends on the rate of expansion (Hubble's constant) $\mathbf{H_0}$.

The exact value of the expansion rate of the universe has been determined ($\mathbf{H_0}$),observation of different values owing itself permittivity of the environment and influence General Relativity Extended.

Therefore, means that one of the intrinsic properties, which were attributed to elementary particles, it actually belongs to space-time (as the process of deformation of the same space-time "gives" to the mass the "property" of gravitational attraction).

Dacă one of the properties of elementary particles belongs to space-time then, by extrapolation, we could consider that all the properties belong to it (even quantification by the appearance of the multiplication factor “n”), and that matter is in fact devoid of properties (it is "sterile"), thus disappearing the problem of the infinity of the mass and electric charge of the electron. This makes all constants actually "belong" to space-time and more easily explain the "strange" properties of matter.

Neutrinos are described as an oscillation whose action can be considered (confused with) that of a particle, it is easy to understand why it can change from one type to another (neutrino metamorphosis), and why it can be confused with its own antiparticle;

At the same time, the critical mass shows us the boundary between quantum theory and classical mechanics – they are no longer in conflict -(see also proposal of Roger Penrose , respectively Lajos Diosi)[5] – it shows us the limit from which space-time influences matter, and from where matter influences space-time, deforming it.

The theory set out above is in agreement with Principle of Correspondence.

Data availabity:

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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