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GRAVITATIONAL MODEL OF THE THREE ELEMENTS THEORY: ILLUSTRATIVE EXPERIMENTS

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Abstract: Some following comments are made about the Gravitational Model of the Three Elements Theory: Formalizing (GMTETF) [1]. Some illustrative experiments related to GMTETF are depicted. Apart from the cutting tests of the model which are designed in order to validate the model, more ambitious tests are proposed, which are only naturally suggested by the model. The astrophysics scale experiments concern only the surrounding model [2], which is a simplified version of the model. At laboratory scale, some of the model's predictions might be revealed by the precision of the future interferometers.

Keywords: relativity, gravitation, surrounding, critical density

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1. Introduction

In the present document some comments will be tried about GMTETF, which will be named "the model".

An important focus will be applied to the second assumption of the model. The macroscopic relation between the privileged frame of the model and energy distribution can be searched for. This will reveal an algebraic structure for the set of boosts.

Another detailed description concerns the fitting process which has been used at the construction of surrounding. It will tune in return the relative values of the contributions of the galaxy and Universe for the calculation of the privileged frame.

An experimentation designed in order to measure the "counteracting effect", a dizzling effect predicted by the model, will be imagined. The three cutting tests of surrounding will be reminded, since this large scale model is derived directly from the model. Then some more ambitious experiments will be imagined, suggesting clues for the search of a new physics.

2. Reminder of the assumptions of the model

Let us remind briefly the four assumptions of the model.

1. Matter is made up of indivisible particles always moving at the speed of light along geodesics. Let us name "IP" such a particle.
2. The space-time structure is determined by a set of successive deformations, each of them is described by a boost. Let us name "boost-like deformation" such a deformation.
3. Each IP is propagating a boost-like deformation through space-time. This propagation evolves at the speed of light. An energy is propagated along this propagation. Let us name "IP gravitational wave" such a wave.
4. The space-time structure is determined only at the intersections of the "future light cones of the IPs". The rule yielding the final space-time deformation resulting from numerous IP gravitational waves, occurring in the same space-time event, is dictated by the principle of energy conservation.

3. Algebraic structure of the set of boosts

The purpose of this paragraph is to study the set of boosts in the context of the model. In this context, the question of the algebraic structure of the set of boosts gets a physical signification through the question of the determination of the privileged frame. Concretely, the question is the evolution of this privileged frame in case of multiple macroscopic particles in motion. The significance of "macroscopic particle" here is "a particle which contains multiple IPs".

The first GR issue which will be reviewed is the issue of the absence of algebraic structure for the set of boosts with the composition operator. Now this question is reformulated the following way. What is the algebraic structure of the set of boosts which describe the evolution of the privileged frame? How is this structure connected to energy distribution of multiple macroscopic particles? This gets here a direct answer in the context of the model. Indeed, after the determination of a privileged R_0 frame, the algebraic structure of the set of (a, B) couples appears, where a is the energy at rest of an object, and B is the boost associated with its motion in R_0. Let us call S this set of couples. The algebraic structure of S is inherited from the f isomorphism from S to the set of energy-momentum four-vectors, such as $f((\mathrm{d}E, B^{\mu}_{\nu})) = \mathrm{d}D^{\mu}$, using the notations of the equations of [1]. It should be noticed that the image of f is the set of energy-momentum four-vectors describing an energy having a speed always strictly below the speed of light. The definition of the induced $*$ operator acting on S is $(a_1, B_1) * (a_2, B_2) = f^{-1}(f((a_1, B_1)) + f((a_2, B_2)))$, with obvious notations. The resulting structure of $(S, *)$ is isomorphic to $(\mathbb{R}^{+*} \times \mathbb{R}^3, \mathrm{op})$, where $\mathbb{R}$ is the set of real numbers, $\mathbb{R}^{+*}$ is the set of strictly positive real numbers, and op is the barycentric operator. Physically it is more relevant to say that this is isomorphic to the set of (a_t, v) couples, where a_t is the total energy of the object, and v, being strictly weaker than c is the speed of the inertial center of the object in a given frame, using the barycentric operator.

Now in this context the GR issue of the order of the boosts in their three dimensional composition can be addressed. Because now this question is reformulated the following way. Is it possible to use the composition of the boosts in three dimensions, for describing the evolution of the privileged frame, and, if so, what is the correct order which must be used? For trying to answer those questions, let us suppose the Universe filled with a constant and uniform distribution of matter, and let us study two A and B objects in this context. If A and B are far enough from each other, the space-time deformation due to A is not noticeable around B and vice versa. In this case an inertial privileged frame R_B attached to B will appear in an inertial privileged frame R_A attached to A following roughly the rule of the composition of the boosts and it will appear a Wigner rotation [3, 4, 5]. But in the context of the model, the space-time structure will be determined without ambiguity. The answer to the question of the order will be conspicuous: R_A to R and then R to R_B. (Here the meaning of "an inertial privileged frame attached to a given particle" is a frame such as its origin is always located in the particle, sharing the same speed as the particle. It is always theoretically possible to obtain such a frame almost approximately, by either decreasing Universe matter density or by increasing the particle matter density.) Now if the Universe becomes empty except A and B then no boost composition will be required and no Wigner rotation will appear. Also if E_A and E_B are the respective energies at rest of A and B, if $E_A \gg E_B$ and if A and B are closed enough to each other so that the space-time deformation of the Universe is not noticeable around A, (that is, the deformations of A and B are the only one noticeable around B), then R_B will appear in R with a Wigner rotation and the choice of the order will be obvious too: R to R_A and then R_A to R_B. The final result is that the answer to the questions of which composition of boosts and which chosen composition order between the macroscopic privileged frames depends of the relative energies associated to those frames.

4. Fitting the surrounding coefficient

The full detail of the fitting process which has been giving the surrounding coefficient will be required further on in the present document. The following surrounding coefficient has been created from a macroscopic simplification of the C_{GMTET} coefficient introduced in [1],

$$C_{\text{surrounding}} = \frac{a\rho_0 + b\rho_{u0}}{c\rho + d\rho_{\text{Universe}}}, \tag{1}$$

where ρ is matter density around the observer below $10\,h^{-1}$ kpc (roughly 15 kpc), ρ_0 is this matter density in the Solar system, ρ_{Universe} is matter density in the Universe, and ρ_{u0} is matter density in the Universe at today's time. The symbols a, b, c, and d denote the fitting parameters.

The value of the gravitational constant G in Solar system would imply $a = c$ and $b = d$. The degree of liberty of the ratio allows to fix $b = d = 1$. It remains only a which is constraint mainly by two different requirements.

- The equivalent G in the IGM.
- The critical matter density of the Universe.

But those two requirements yield different values of a. They can be approximately met but this would not allow a correct simulation of the galaxy speed profiles. The equality $b = d$ is required, because $C_{\text{surrounding}} = 1$ in Solar system. But for the same reason there is $a = c$ in the galaxy. That is why it has been supposed the existence of a shielding effect in a galaxy. Then, in place of supposing $a \neq c$, it has been supposed the existence of an α coefficient taking the role of such a shielding effect. It has two different values, α_{in} for an observer located in the Milky Way, and α_{out} for an observer located outside of any galaxy. The new formulation of the ratio is the following

$$C_{\text{surrounding}} = \frac{\alpha_{\text{in}}\rho_0 + \rho_{u0}}{\alpha\rho + \rho_{\text{Universe}}}. \quad (2)$$

However, this simple formulation remains constraint by the four following requirements:

1. The equivalent G in the IGM.
2. The critical matter density of the Universe.
3. The equivalent G in a void.
4. The simulations of the speed profiles of the galaxies.

And this is quite an achievement: it is possible to find values for those two variables, α_{in} and α_{out}, while matching those four requirements.

- α_{out} gets the value 1. By itself this is also noticeable.
- α_{in} gets the value $1.6 \cdot 10^{-5}$. The order of magnitude of this particular value can be directly observed when simulating galaxies. One starts from the following equation.

$$C_{\text{surrounding}} = \frac{A}{B + C\rho}. \quad (3)$$

Then it is seen immediatly $B \neq 0$. Because of $B = 0$, the simulated speed profile of a galaxy becomes irrelevant. On the contrary, $B \gg C\rho_0$ simply yields no modification of Newton's law. When trying different configurations for the values of B and C (A is only the degree of liberty of the ratio), it appears quickly that B and $C\rho$ must not differ by more than one order of magnitude. And interestingly this is in accordance with the four previous requirements altogether. The second requirement above implies $(\alpha_{\text{in}}\rho_0 + \rho_{u0})/(2\rho_{u0}) = 1/\Omega$, where the used value for the relative critical density is $\Omega = 0.05$. Then we have the following result:

$$\alpha_{\text{in}}\rho_0 = 39\rho_{u0}. \tag{4}$$

It is in contradiction with the results of the calculations of [1], which supposes that Newton's law is valid at any scale. Hence, it tends to show that gravitation would be weaker than Newton's law for interacting distances beyond 15 kpc which is approximately the ray of the galaxy we are living in. This has also consequences in the determination of the privileged frame, which will be used further on in the present document.

5. Experimentations

It will be studied two different kind of experimentations relative to the model.

The first kind of experimentation will be named "cutting test", that is an experimentation which is intended to validate or invalidate the model. It means that if such an experientation succeed, then either the model is validated, that is, confirmed, either it is invalidated.

The second kind of experimentation will be called "clue for the search of a new physics". Such an experimentation is testing only a suggestion of the model. This more or less direct suggestion is not a prediction, or it might be called a "very soft" prediction.

5.1. Cutting tests

Let us try to list the set of tests which are able to validate or invalidate the model (the "cutting tests"). The following features of the model will be concerned.

1. The "counteracting effect" of the second assumption.
2. The surrounding effect at large scale (for interaction distances greater than 15 kpc).

5.1.1. Testing the counteracting effect

The "boost" which is refered to in the second assumption describes the space-time deformation of the model. It does so by determining successively the evolution of a particular frame, called the "privileged frame". At each step of the dicrete GMTETF model, locally the speed of this frame with respect to the previous one, is exactly opposite to the speed, with respect to the previous frame, of the interleaved added matter. This particular behavior will be called "counteracting effect".

This dizzling characteristic suggests a cutting test of the model. It consists in testing this counteracting effect.

Therefore, it consists in testing the space-time deformation generated by matter in motion as predicted by the model. What happens is that the privileged frame is modified by the motion of matter, at the location of this matter. It means that if some important amount of matter is at rest in the laboratory at time $t = t_0$, and then put into motion at a high speed V at $t = t_1 > t_0$, it will generates the following consequence (now in the present document this matter in motion will be simply named "matter in motion").

- The privileged frame of the laboratory at $t = t_0$ goes into motion at $t = t_1$ with a v speed opposite to V, with respect to its previous location at $t = t_0$.

Of course, the privileged frame on Earth, far from the matter in motion, is still the same. It means that at a location far from the matter in motion no change is noticed between t_0 and t_1. But the privileged frame located close to the matter in motion is not the same. If the effect is strong enough it will produce matter distorsion and stress in the laboratory. The speed v is given by the following equation:

$$v \simeq -V \frac{\sum_{n=0}^{N} \mathbb{1}(x, y_n, u_n) \sqrt{\frac{E_t(y_n)}{\|x - y_n\|_3}}}{\sum_{n=0}^{M} \mathbb{1}(x, y_n, u_n) \sqrt{\frac{E_t(y_n)}{\|x - y_n\|_3}}}. \tag{5}$$

This equation is in fact an approximation, but it's a good aproximation on earth. The notations has been defined in [1], let us remind them:

- n is the IP number of the IP located at the y_n event.
- x is the location of the laboratory.
- $\|x - y_n\|_3$ is the distance between x and y_n (space distance, calculated in a co-variant manner).
- $\mathbb{1}(x, y_n, u_n) = \delta(\|x - y_n\|_3 - x^0 + y_n^0)\delta_E(u_n \cdot u - \sqrt{2}/2)$ is used for selecting the IPs which are taken into account in the sums.
- $\delta(\|x - y_n\|_3 - x^0 + y_n^0)$ tells that the IPs must be located on the past light cone centered in x.
- $\delta_E(u_n \cdot u - \sqrt{2}/2)$ tells that the IPs on this cone propagate a gravitational wave in x only if their initial orientation allows it. But in the macroscopic version of (5), in which only the means values are considered, for IPs pertaining to matter, not pertaining to light, matter being approximately at rest with respect to the earth, this $\delta_E(u_n \cdot u - \sqrt{2}/2)$ term is always equal to 1. It means also that the energy of light in the Universe is considered relatively negligible.

The IPs which are numbered with a n number between 0 and N are those which are parts of the matter in motion.

The IPs which are numbered with a n number between 0 and M are simply the IPs of the observable Universe.

In order to only illustrate this particular behavior, let us imagine an experimentation. In the present document any comments about experimental physics will be done only on this purpose of illustration. So as a matter of example, one related experiment might consist in using a 300 m high and 2 m diameter pipeline connected to an upward lake. Far from the location of the measurement the pipeline is vertical or almost vertical, then it is slowly curved in order to be horizontal at the location of the measurement. At this location a mirror is placed into the tube, or very closed to it. Its horizontal location is measured by an interferometer. This one measures the distance between this first mirror, and a second mirror located far from the pipeline in order to avoid the predicted effect. The experiment is trying to detect a modification of this measured distance, therefore, to detect a motion of the first mirror with respect to the second one. A first measurement is done at $t = t_0$ when the pipeline is empty. A second one is done at $t = t_1$ when the pipeline is full of water in motion at 10 m/s.

The prediction of the model is the following. Between t_0 and t_1 the first mirror should be put into motion at the v speed given by equation (5).

Let us rewrite some of the equations and inequalities of [1]:

$$\frac{S_w(\text{laboratory})}{S_w(\text{galaxy})} = \frac{\rho_{\text{laboratory}}}{\rho_{\text{galaxy}}} \left(\frac{R_{\text{laboratory}}}{R_{\text{galaxy}}}\right)^{5/2} \simeq 3\ 10^{-29} \tag{6}$$

$$\frac{\rho_{\text{galaxy}}}{\rho_{\text{Universe}}} \left(\frac{R_{\text{galaxy}}}{R_U}\right)^{5/2} Ex \simeq 10^{-7} < \frac{S_w(\text{galaxy})}{S_{\text{Universe}}} < 1 \tag{7}$$

where $S_w(\text{laboratory})$ is the value of the sum which is the numerator of the ratio of the rhs of (5) in the particular case in which the matter in motion is a sphere of ray equal to $R_{\text{laboratory}}$, and in which x is the center of this sphere. Furthermore, $S_w(\text{galaxy})$ is the same calculation modelizing in a very rough manner the galaxy by such a sphere with a ray equal to R_{galaxy}, and S_{Universe} is the value of the sum which is the denominator of the ratio of (5). $Ex \simeq 0.22$ is the coefficient due to expansion. The symbols $\rho_{\text{laboratory}}$, ρ_{galaxy}, and ρ_{Universe} are the associated matter densities with obvious notations. Also $R_{\text{laboratory}}$ and R_{galaxy} are the respective rays, and R_U is the particle horizon. It has been used $\rho_{\text{laboratory}} = 10^3\,\text{kg/m}^3$, $R_{\text{laboratory}} = 1\,\text{m}$, for taking into account the 2 m diameter pipeline. It has been used $\rho_{\text{galaxy}} = 0.003\ M_0/\text{ly}^3$, where M_0 is the mass of the Sun, $R_{\text{galaxy}} = 15\,\text{kpc}$, and $\rho_{\text{Universe}} = 9.24 \cdot 10^{-27}\,\text{kg/m}^3$.

But it has been shown above that the behaviour of surrounding allows to expect a much greater value for the weaker bound of (7). Indeed, the $S_w(\text{galaxy})/S_{\text{Universe}}$ ratio is driving the numerator of the surrounding modifying coefficient, which is reminded in equation (2). And the latter one is strongly constraint as it has been shown. The related terms of equation (2) are $\alpha_{\text{in}}\rho_0 = S_w(\text{galaxy})$, $\alpha_{\text{in}}\rho_0 + \rho_{u0} = S_{\text{Universe}}$. Then with equation (4) it goes $S_w(\text{galaxy}) = (39/40)S_{\text{Universe}} \simeq S_{\text{Universe}}$. The result is that the inequalities of (7) are replaced by the following approximation.

$$\frac{S_w(\text{galaxy})}{S_{\text{Universe}}} \simeq 1. \tag{8}$$

Now it results the following R ratio and the resulting speed of (5):

$$R = \frac{S_w(\text{laboratory})}{S_{\text{Universe}}} \simeq 3 \cdot 10^{-29}, \tag{9}$$

$$v = VR \simeq 3 \cdot 10^{-28}\,\text{m/s}. \tag{10}$$

A mirror moving freely horizontally, close to the matter in motion, would travel approximately the following $d = vT_{\text{meas}}$ distance after $T_{\text{meas}} = 1\,\text{hour}$,

$$d \simeq 10^{-24}\,\text{m}. \tag{11}$$

This very low value might generate no stress in matter, even for a mirror solidely attached to the laboratory. Nevertheless, it might be compared to the possible strain sensitivity of the future KAGRA interferometer [6]. For example, a $L = 1\,\text{km}$ long KAGRA interferometer (distance between the two mirrors) having a strain sensitivity of $s = 10^{-29}\,\text{Hz}^{-1/2}$ operating at $\nu = 100\,\text{Hz}$ would admit a N absolute noise given by the following equation

$$N = Ls\sqrt{\nu} = 10^{-25}\,\text{m}. \tag{12}$$

Therefore, it sounds possible to compare the prediction of equation (11) with the measurement. But, among others, the presence of the matter in motion close to the first mirror will produce vibrations which might forbid this detection even with the values given by equations (11) and (12).

5.1.2. Testing surrounding

There are also theoretical differences between GR and the model at astrophysical scale, concerning the determination of the privileged frame. They have been discussed in [1], and they seem to be difficult to test at this scale.

Compared to the counteracting effect, which is an inner part of the second assumption, the surrounding effect is a behavior which is induced by the assumptions. Nevertheless, this effect is inherent to the main equation of the model. Therefore, testing this effect is testing the model with a cutting test. In [2] it was noticed that there are three tests of surrounding. They are reminded below and in Table 1.

Intragalactic

This test consists in continuing the simulation of a galaxy under the surrounding model. A specific focus on flat profiles of giant galaxies might be done.

Extragalactic

This test consists in detecting a particular correlation between matter density and the equivalent G, outside of any galaxy. The following equation is predicted.

$$\frac{G'}{G} = 2\frac{\rho_c}{\rho + \rho_u}, \tag{13}$$

G is the gravitational constant,
G' is the equivalent value of G as predicted by the model,
ρ is the matter density calculated in a 15 kpc ray sphere centered in M,
ρ_u is the matter density of the Universe at the time of the M event, and
ρ_c is Universe critical matter density.

Large scale structure
Surrounding predicts a particular stable equilibrium and a particular matter distribution in this equilibrium state. This distribution of matter is given by the following equations

$$\rho = (\rho_{\text{wall}} + \rho_u)\,\frac{x_{\text{wall}}}{x} - \rho_u, \tag{14}$$

where x is the distance from the nearest wall, x_{wall} is half the width of this wall, ρ_{wall} is the matter density of the wall, and ρ_u is Universe matter density.

Equation (14) shows a void falling into complete emptiness at this x_e distance from the nearest wall,

$$x_e \simeq \frac{\rho_{\text{wall}}}{\rho_u} x_{\text{wall}}. \tag{15}$$

Therefore, the test consists in measuring the observed matter density distribution which is used in those equations, and then checking if those equations are retrieved.

5.2. Clues for the search of a new physics

The model gives some clues for the search of a new physics. Indeed it suggests quite naturally a particle physics in which the four forces would be driven by its equation. This would result in surrounding effects occuring in particle physics. It means that as well as gravitation, each of the three remaining forces would be weakened or increased by surrounding matter density, depending on wether this matter density is increased or decreased, respectively.

This remark might lead to clues for the search of a new physics. But for this a simple modelization of the electron and the photon in the context of the model has to be introduced.

5.2.1. The model and particle physics

The GMTETF model was untitled a “Gravitational Model” (GM). But one might notice that this model by itself naturally suggests a unifying theory. The first step would be to describe the composition of each particle of the standard model under the context of the first assumption. The trajectory of IPs inside each particle would be detailed. And the second step would be trying to retrieve particle physics from this “extended GMTETF”. Of course, this would be a huge work.

In order to retrieve the Planck-Einstein relation, the trajectory of an IP pertaining to a photon would be an helix. And in oder to retrieve electromagnetism, an electron would be quickly modelized by an IP trajectory having the shape of an helix engraved on the surface of a torus. Indeed this seems to be the way to retrieve electromagnetism in this context. Those descriptions are of course only suggested, not proven by any means. Let us remind that the aim is to find clues for the search of a new physics. In the present document such a modelization will be called TET ("Three Elements Theory").

Another remark about particle physics is that the surrounding effects predicted by the model suggests [7] a solution to the mass gap and confinement problems [8, 9].

5.2.2. Surrounding effects in particle physics

Interestingly some apparently good ideas there might lead nowhere. For example, a measurement of the hydrogen spectral rays under different surrounding contexts would probably shows no variation at all. Indeed, the energy levels are function of the fine structure constant. But recent developments [10] tend to show that this constant having no unit is related to the geometry of a particular modelization of the electron. And this modelization is similar to the GMTETF modelization introduced above. Therefore, measuring the atom spectral rays might not show anything new.

This absence of surrounding effects might concern other measurements in the field of particle physics. Hence, a good practice would be to restrict ourselves only to explicit or implicit measurements of space-time trajectories.

One of these measurements are the cross sections of particles, since they measure the trajectories of the interacting particles. But on earth the required precision might not be enough as compared to the R ratio of equation (9). The same "double" experiment on earth and also far from earth (in orbit for example) would allow to test the prediction of a much stronger ratio:

$$\frac{S_w(\text{Earth})}{S_{\text{Universe}}} \simeq \frac{S_w(\text{Earth})}{S_{\text{galaxy}}} \simeq 10^{-11}$$

with the notations and values of [1].

Once again a good precision might be obtained by an interferometer, measuring either a distance or a light frequency. In the context of the model the Planck-Einstein $E = h\nu$ relation suggests that the energy of the IP pertaining to the photon modifies its own helicoidal trajectory, and therefore its own frequency. Indeed, the space-time deformation would be increased with the IP energy, decreasing the helix's ray. In such a case it would appear also surrounding effects. Decreasing or increasing respectively the surrounding matter density would result respectively in increasing or decreasing the space-time "elasticity", hence decreasing or increasing the ray of this helix, and then increasing or decreasing the photon's frequency. The conclusion here is that the surrounding effect of the model might modify the Planck constant.

Let us try to illustrate this by the description of a possible experimentation. An already existing gravitational wave interferometer [11] is modified, covering only one arm of the two arms ot the interferometer with a 1 m ray pipeline, without modifying the arm itself. The result is that this arm is located in the axis of this pipeline. Then the first measurement detects the location of the interference fringes with an empty pipeline. The second measurement is exactly the same one but using a pipeline full of water. The prediction is a relative difference of the measured frequencies given by the R ratio of equation (9). Using a reference frequency of 100 Hz, it would result in a frequency shift of 10^{-27} Hz. Of course, the recent interferometers do not allow such a precision, but this value might be obtained by future versions [6]. Also the suggested experimentation might be improved for example replacing the pipeline by a channel.

5.2.3. Miscellaneous experiments

Another idea would be of searching for possible violations of the linearity of the gravitational force. Indeed it has been shown in [1] that a slight modification of the model can lead to such a violation. For example, the eclipse anomaly [12] might find here the beginning of an explanation, since the lenticular effect occuring during an eclipse increases light beam densities and also the intensity of the microscopic waves predicted by GMTET. Unfortunatly, the observed anomaly is a decreasing gravity, whereas the prediction would be an increase. But this is an example of what might be searched for. Another example might be the Pioneer anomaly [13]. Indeed, if any non-linearity would be predicted by the model, then of course this location would be one of the locations, in the Solar system, in which this non linearity would be very strong. Those best locations would be the ones wich are aligned with the sun and Saturn, or with the Sun and Jupiter, and of course having the coresponding planet and the Sun on the same side.

It might be possible also to search for this non-linearity at laboratory scale. The experiment would be for example aligning numerous spheres of lead and measuring the value of the gravitational constant on this straight line while successively modifying the number of aligned spheres.

Another clue for this quest of a new physics is given by TET. Then the experiment would try to detect the existence of any magnetic or electrostatic field in the vicinity of a light beam propagating in an optic fiber following a particular shape. The simplest shape would be the shape of an helix having its axis following a circle. A complicated shape would be the shape of an helix having its axis following a bigger helix, with the axis of this bigger helix following a circle.

Table 1 shows the cutting tests of the model. Table 2 shows the "clue" experiments for the search of a new physics, which are suggested by the model.

6. Discussion

The determination of the privileged frame of the model reveals macroscopically an algebraic structure of the set of boosts, which is related to energy distribution.

The fitting process of surrounding tends to show that gravitation would be weaker than Newton's law for interacting distances beyond 15 kpc. This has also consequences in the determination of the privileged frame.

Scale	Tested behavior	Cutting test experiment
Astrophysical	Galaxy speed profiles	Simulating and comparing with experimental data
Astrophysical	Surrounding effect in IGM[a]	Measuring the equivalent G and matter densities
Astrophysical	Large scale structures	Measuring matter distribution at large scale
Laboratory	Counteracting effect	Detecting an induced motion[b]

Table 1: Cutting tests of the model: [a]Intergalactic medium, [b]The particular counteracting effect of the second assumption is tested.

Scale	Tested behavior	Experiment
Laboratory	Surrounding effects	Measuring a light frequency[a]
Laboratory	Linearity[b]	Measurement of G using aligned spheres
Solar system	Linearity[b]	Measurement of the gravitational force[c]
Laboratory	Generation of an EM[d] field	Measurement of an EM field[e]

Table 2: Suggested experiments based on the model, imagined in order to give clues for the search of a new physics: [a]A possible variation of the Planck constant with surrounding matter density is suggested by the model, [b]A possible violation of the linearity of the gravitational force is suggested by the model, [c]Measurement of the evolution of the gravitational force along the "Saturn-Sun" line, and "behind" Saturn from the Sun, [d]"EM" is an acronym for electromagnetic, [e]Measurement of electrostatic and magnetic fields close to a dedicated fiber optic apparatus.

The most promising experimentation suggested by the model has been depicted. It consists of testing the conteracting effect predicted by the model. It seems to be difficult to realize, because of the added noise generated by the motion of matter during the experiment. It requires a sensitivity which is not afforded by the existing interferometers. But this could be afforded by the future interferometers.

The other cutting tests concern only surrounding. Those are astrophysical measurements.

In the laboratory scale, there exist also tests which are not cutting tests but only tests which are suggested by the model. One of them is testing the evolution of the Planck constant with surrounding matter density.

Can we expect to reveal a new physics?

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