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**TITLE: ELEMENTS OF COSMOLOGY IN THEORY OF ETHER**

**Abstract:**

In a first article,(T.Delort, Theory of Ether, Phys.Essays **13**,4 (2000)), we have shown the compatibility of the Theory of Ether (T.E) with the whole of experiments concerning Special Relativity (S.R) and with Quantum Physics. In this article, we keep on studying Cosmology with T.E. We present a drastically new and simple conception of Cosmos. We also interpret for instance the origin of Black Mass, inside the density of the Universe . We obtain all these results concerning Cosmology without using General Relativity (G.R). Using fossil radiation, we also obtain the velocity of the sun relative to the Ether.

So this conception of the Universe is much simpler and much clearer than the conception involved by General Relativity. It avoids the use of Riemann geometry and of the tensor of Einstein.

**Key words:** ether, Black mass, Miller's experiment, velocity of light,fossil radiation, Law of HUBBLE

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## 1. INTRODUCTION

In a first article , (T.Delort, Theory of Ether,Physics Essays, **13**,573 (2000)) , having set some Postulates of this Theory of Ether (T.E), we have showed that T.E could interpret the whole of experiments interpreted presently by Special Relativity (S.R).

We have also proposed some experiments interpreted by T.E which could confirm it, for instance the study of Transversal Doppler Effect.

Here we keep on studying some experiments and Cosmology with T.E. .

In Cosmology, we present the new conception of the Universe implied by T.E and we show that it is more precise and simpler than in Relativity. This conception is very different from the present one. T.E permits also to obtain new results such as the origin of Black Mass, the density of the Universe, the isotropy of Fossil radiation and the velocity of the earth relative to the Ether. Moreover T.E permits to avoid the use of Einstein's Tensor and of Riemann's geometry in an important part of Cosmology and consequently is mathematically and physically much simpler than the Theory of Relativity

In the present article, we will only study the fields of S.R and of Cosmology using the **Postulates 1, 2, 7** presented in the article Theory of Ether cited above.

Let us recall all the elements of the Theory of Ether that are necessary to understand this article.(All those elements are completely exposed in the article (T.Delort,Theory of Ether,Phys. Essays,13,573, (2000)):

-An Ether, fixed Referential does exist . (Fundamental Principle of T.E);

We note  $R(O,X,Y,Z,T)$  a Referential,Absolute Referential , linked to the Ether.

-Galilean Referentials are Referentials driven with a constant velocity, (without rotation) relative to the Ether (or to  $R$  ).

In the part of the article, COSMOLOGY, we use the following elements:

-The moving Energy (or mechanical Energy) of a particle with a mass  $m$  driven with a velocity  $v$  relative to the Ether (Absolute fixed Referential  $R(X,Y,Z,T)$ ) is (**Postulate 1**):

$$E = \frac{mc^2}{\sqrt{1 - v^2/c^2}} \quad (1)$$

And **Postulate 7**:

-If a photon has a length of wave  $\lambda$  and is in a region of space submitted to a factor of expansion  $f$ , then its length of wave is submitted to the same factor of expansion  $f$ . It becomes:

$$\lambda' = \lambda \times f \quad (2)$$

-The Universe is like a swelling balloon whose borders move at a velocity  $c$ .

We assume also that according to T.E, a substance, called also Ether, fills the Universe, and we study some of its properties in this article.

## 2. RESULTS –APPLICATIONS OF THE THEORY OF ETHER-COSMOLOGY

### Introduction

According to the Theory of Relativity, there is no Ether.

According to the Theory of Ether, Ether is a substance that fills all the Universe; (See the Chapter 1. INTRODUCTION of the article). It is necessary to study this substance and to make the hypothesis that it has a mass, because a-priori any substance could have a mass. So in this Chapter, we will make the hypothesis that the Ether (and consequently any element of Ether) has a mass. We are going to see that this hypothesis permits to find an origin to Black Mass and to explain the curve of velocities of stars in Spiral galaxies and also to obtain simply many fundamental results in Cosmology. The Ether filling all the Universe, its simplest model is an ideal gas, and so we will consider this model. To begin with, we remark that presently, 85% of the density of the Universe has a non baryonic origin, and a massic Ether gives an origin to it.

### 2.1 Black Mass

Actually Cosmology meets 2 important problems: More than 90% of the mass of the Universe is from unknown origin, and some observations showed that the velocity of stars in Spiral Galaxies was independent from their distance to the center, despite that it should decrease with distance.

We are going to show that the existence of a massic Ether could explain the origin of the Black Mass and give an explanation to the observed velocities of stars.

We are going to show that the presence of a massic Ether obeying to the law of Ideal Gas explains this last phenomenon, and consequently we can suppose that the Black Mass is in fact constituted of Ether, and this would explain why it is invisible.

Interstellar dust cannot be considered as a gas and moreover, its estimated mass is much weaker to be the Black Mass.

So let us establish why with our hypothesis, the velocity of stars in a Galaxy should be independent from their distance to the center.

We suppose that Ether has a mass and that it behaves approximately as an ideal gas, following the law:

$$PV = k_0 m T \quad (3)$$

For a homogeneous element of Ether of pressure  $P$ , volume  $V$ , Temperature  $T$ , mass  $m$ .

In the Solar system, if  $M$  is the mass of the sun,  $m$  mass of a planet turning around it,  $v$  the velocity of the planet, and  $r$  its distance to the sun:

$$\frac{mv^2}{r} = \frac{GMm}{r^2}$$

$$v^2 = \frac{GM}{r} \quad (4)$$

So the planet velocity decreases when its distance to the sun increases.

For a star in a Galaxy, the formula (4) is still valid if we take  $v$  as the velocity of the star,  $r$  its distance to the center of the Galaxy and  $M$  the mass of the Sphere of radius  $r$  and as center the center of the Galaxy.

If we suppose that  $M$  is mostly constituted of Ether, and if we prove that in that case  $GM/r$  is constant, then according to Equation (4), we will prove that  $v$  is independent of  $r$ .

It is normal to suppose spherical symmetry for concentration of Ether as it exists for Celestial objects, stars, planets etc..So we suppose:

-The density of Ether in a point depends only on its distance to the center (Spherical symmetry):

$$\rho = \rho(r) \quad (5)$$

-In any point, the pressure depends only on its distance to the center of the Galaxy:

$$P = P(r) \quad (6)$$

We also suppose that the Ether obeys to the Law of ideal gas and ,making  $T=(\text{constant})$ , the Equation (3) becomes:

$$PV = k_1 m \quad (7)$$

With  $k_1 = T k_0$ ,  $m$  the element of Ether,  $V$  its volume,  $P$  its pressure and  $m$  its mass.

Writing the precedent law (Equation (7)) for an elementary volume  $dV$  containing an element of mass  $dm$  and situated at a distance  $r$  from the center of the Galaxy we obtain:

$$P(r) dV = k_1 dm, \text{ so:}$$

$$P(r) = \frac{k_1 dm}{dV} = k_1 \rho(r) \quad (8)$$

$$\text{Because } (dm/dV) = \rho(r)$$

In fact, we are going to prove that :

$$\rho(r) = \frac{k_2}{4\pi.r^2} \quad (9)$$

,  $k_2$  being a constant that we are going to determine, defines a system in agreement with the laws of dynamics, and consequently that such systems can exist in the universe.

To do this we are going to prove that  $\rho(r) = k_2 / (4\pi r^2)$  (Equation (9)), is solution of the Equation of Equilibrium between the forces of pressure and the forces of Gravitation. We call Hypothesis 1 this Equation (9).

So we suppose Hypothesis 1, (Equation (9)) and we are going to prove that then the Equation of Equilibrium is true.

Let O be the center of the Galaxy, and S the Sphere (full of Ether) of radius  $r$  and of center O.

The mass of the sphere S is, according to Hypothesis 1 (Equation (9)):

$$M = \int_0^r 4\pi \cdot x^2 \rho(x) dx = \int_0^r \frac{4\pi \cdot x^2 \cdot k_2}{4\pi \cdot x^2} dx = k_2 r$$

$$M = k_2 r. \quad (10)$$

Let us now write the Equation of the equilibrium of forces for an element of surface  $dS$  and of width  $dr$  tangent to the empty sphere situated between the distance  $r$  and  $r + dr$  from O:

$$P(r + dr)dS + \frac{GM}{r^2} dm - P(r)dS = 0 \quad (11)$$

With :

- $dm$  mass of the element of the empty sphere of surface  $dS$  and of width  $dr$

- $P(r)$  pressure of the Ether at the distance  $r$ .

- $M$  mass of the full sphere of radius  $r$ .

So we have :

$$dm = \rho(r)dS dr \quad (12)$$

According to Equation (10):  $M = k_2 r$ .

Moreover, according to Equation (9):

$$dm = \rho(r)dS dr = \frac{k_2}{4\pi \cdot r^2} dS dr \quad (13)$$

So:

$$\frac{GM}{r^2} dm = G \left( \frac{k_2 dr dS}{4\pi \cdot r^2} \right) \cdot \left( \frac{k_2 r}{r^2} \right) = \frac{Gk_2^2 dr dS}{4\pi \cdot r^3} \quad (14)$$

So the Equation of Equilibrium (11) becomes, dividing by  $dS$ :

$$P(r + dr) + \frac{Gk_2^2 dr}{4\pi.r^3} - P(r) = 0 \quad (15)$$

$$\frac{dP}{dr} = \frac{-Gk_2^2}{4\pi.r^3} \quad (16)$$

According to Equation (8):  $P(r) = k_1 \rho(r)$ , then using Equation (9) (Hypothesis 1):

$$P(r) = \frac{k_1 k_2}{4\pi.r^2} \quad (17)$$

So the Equation of Equilibrium (15) is compatible with Hypothesis 1 (Equation (9)) if Equation (16) is verified:

$$\frac{d}{dr} \left( \frac{k_1 k_2}{4\pi.r^2} \right) = \frac{-Gk_2^2}{4\pi.r^3} \quad (18)$$

$$\frac{d}{dr} \left( \frac{k_1 k_2}{4\pi.r^2} \right) = \frac{-Gk_2^2}{4\pi.r^3}$$

This is true if:

$$\frac{-2k_1 k_2}{4\pi.r^3} = \frac{-Gk_2^2}{4\pi.r^3}$$

or :

$$2k_1 k_2 = Gk_2^2$$

or :

$$k_2 = \frac{2k_1}{G} \quad (19)$$

So we proved that if  $k_2 = 2(k_1/G)$ ,  $\rho(r) = k_2/4\pi r^2$  is solution of the problem, this means that Hypothesis 1 (Equation (9)) is compatible with the Equation of Equilibrium (15).

Then if a star E is at a distance  $r$  of O, according to Equation (4):

$v^2 = (GM/r)$ , and using Equation (10):  $M = k_2 r$ , we obtain:

$$v^2 = G k_2 = 2 k_1 \quad (20)$$

(using Equation(19)), and this proves that  $v$  is independent of  $r$ .

In fact we have proved that the system defined by  $\rho(r) = k_2/4\pi r^2$  with the above value for  $k_2$  was in equilibrium, according to the laws of dynamics in our hypothesis that the Ether substance follows the law of ideal gas. This means that such systems

can exist in the Universe, and such systems explain the curve of velocities in galaxies.  
This shows that the Ether substance is probably the black mass.

So we see again that the mass of Ether could be the Black Mass.

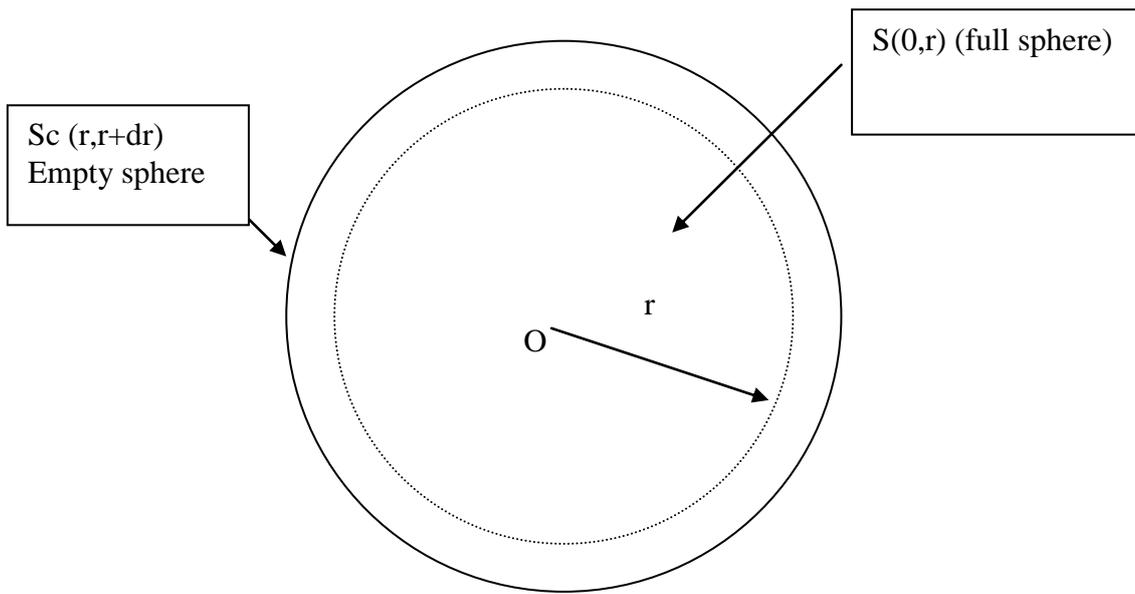


Figure 1: Concentration of massic Ether-Empty sphere and full sphere. Illustration of Chapter **Black mass**.

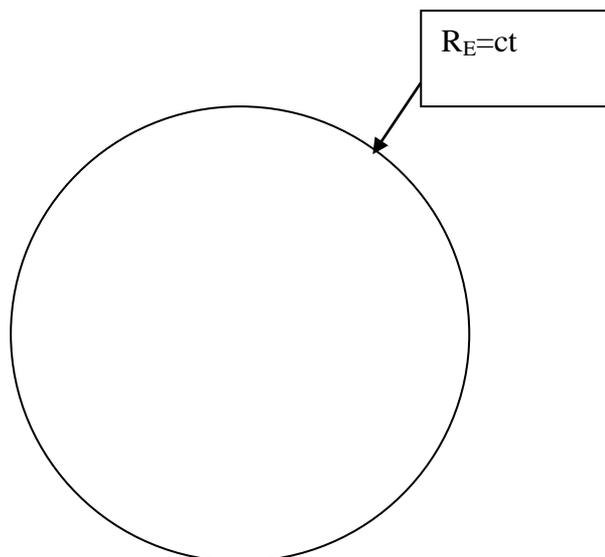


Figure 2: The homogeneous sphere of the Universe.

## 2.2 Structure of the Universe- Law of Hubble

### 2.2.1 *The homogeneous sphere of the cosmos*

We are going to obtain some important results in Cosmology with T.E (Theory of Ether) in a much simpler way than in General Relativity.

We saw in **Postulate 7** (see **1. INTRODUCTION**) that the Universe was like a swelling sphere whose borders move at velocity  $c$ . We also saw that Ether was massic and constituted the Black Mass.

So we can assume that the Ether is homogeneous inside the sphere, this means that the density of Ether is the same in all the Universe. This is natural if we consider as previously that the Ether behaves like a gas.

Of course Ether is not completely homogeneous because according to the previous chapter, we have concentrations of Ether in galaxies, but those spots of inhomogeneity are punctual. The fact that we consider the density as constant in the intergalactic space implies that we make the hypothesis that gravitational effects are negligible and we must justify this hypothesis because in the previous chapter we saw that gravitational effects were fundamental in the case of galaxies. We can intuitively understand this phenomenon.

In fact in the case of galaxies, we are in a static case. In the case of intergalactic space, we are in a non-static case of the expansion of the Universe. We will see that velocity of the elements of the Ether substance increases when we move away from the centre of the Universe. This implies that elements of Ether substance do not compress with their weight their neighbour interior elements, so contrary to the case of galaxies the pressure due to gravitation does not exist. Moreover we can assume that the absolute emptiness, meaning the space without Ether can be considered as having a negative pressure, and so it is always filled by Ether, with the condition that the velocity of the elements of Ether substance is always inferior to  $c$ . So there is a phenomenon of aspiration (comparable to the phenomenon in an aspiration pump) that cancels the effects of gravitational attraction of the elements of Ether substance. This effect of aspiration could also be the cause for which the borders of the Universe move at velocity  $c$ . So our hypothesis that gravitational effects on the elements of Ether substance in the intergalactic space was negligible is justified, because we are in a non-static case of expansion of the Universe, with velocities increasing from the centre towards the borders and because of a phenomenon of aspiration cancelling the effects of gravitation.

### 2.2.2 *Law of Hubble inside the sphere*

We are going in this Chapter to establish that the Law of Hubble is true inside the sphere.

We saw in the Chapter “Black Mass” that the Ether could be considered as a gas, which was the simplest model of the Ether. Because of this we make the hypothesis that the density of ether is constant inside the sphere. .

We saw that the border of this external sphere moved at velocity  $c$ .

So if  $R_E$  is the radius of the external sphere and  $t$  is the age of the Universe (Absolute time), we have  $R_E = ct$ , or:

$$\frac{d}{dt}(R_E) = \frac{R_E}{t}, \text{ or}$$

$$\frac{d}{dt}(R_E) = H_E R_E \quad (21)$$

with  $H_E = 1/t$

So the border of the external sphere follows the Law of Hubble.

We are now going to prove easily that if a sphere is homogeneous and has its border that follows the Law of Hubble, then each point of this Sphere follows the Law of Hubble.

We suppose that the radius of the sphere is  $R_0(t_0)$  at time  $t_0$ . At time  $t_0$ , we suppose that an element of Ether is at a distance  $R_1(t_0)$ , with  $R_1(t_0) = \beta R_0(t_0)$ . Then because the sphere is homogeneous, at any time  $t$  we have:

$$R_1(t) = \beta R_0(t) \quad (22)$$

(Notice that  $\beta$  is independent of  $t$ )

We deduce from this:

$$\frac{d}{dt}(R_1(t)) = \beta \frac{d}{dt}(R_0(t)) \quad (23)$$

But we have supposed that the border of the sphere followed the Law of Hubble, so it exists  $H$  verifying:

$$\frac{d}{dt}(R_0(t)) = H R_0(t) \quad (24)$$

And consequently we obtain:

$$\frac{d}{dt}(R_1(t)) = H R_1(t) \quad (25)$$

So the Law of Hubble is true for all sphere.

We have showed in the Chapter **Black Mass** that the galaxies are mostly constituted by concentration of massic Ether. So we can consider that they float in the Ether and consequently follow the Law of Hubble with:

$$H = 1/t \quad (26)$$

If we take for  $H$  the present admitted value  $H = 1/(15 \text{ billion years})$ , and if we consider that it is the Hubble constant of the external sphere, we obtain an age of the Universe equal to 15 billion years (instead of 10 billion years in G.R), in agreement with the age of the oldest stars.

So according to Theory of Ether, the Universe has a very simple model, a sphere whose the borders move at a velocity  $c$ .

According to General Relativity, we ignore the real model of the Universe. Many complex models are possible. In this Theory (R.G), the simplest models are infinite. But many different infinite models are possible. And the existence of an infinite Universe, with an infinity of stars, with an infinite energy is far less conceivable that a finite Universe, with a finite number of stars.

Moreover an infinite Universe implies with the Law of Hubble that some stars move away each other with velocities much greater than  $c$ , and this is a problem for Special Relativity.

In the next Chapter *Fossil Radiation*, we are going to prove that if we consider the sphere as a black body we can obtain fossil radiation.

### 2.2.3 Fossil Radiation

According to Theory of Ether,we saw in **1. INTRODUCTION**, Equation (2) that the length of wave of a photon increases in the same proportion as the factor of the expansion of the Universe. .

According to what precedes, the radius of the external sphere grows in  $R= ct$  ,(Postulate 7 ). We are going to prove that if  $f$  is the factor of expansion of the Universe, if initially the sphere is a black body at a temperature  $T$ , then after the expansion of a factor  $f$ , the sphere behaves as a black body at a temperature  $T/f$ . So this is the origin of the fossil radiation.

Suppose that we have a photon with  $\lambda = cT$  as length of wave,  $\nu = \omega/2\pi$  its frequency,  $\omega$  its pulsation. Then according to Equation (2), if its area is submitted to a factor of expansion  $f$ , its length of wave becomes:

$\lambda' = \lambda f$ , and consequently its period  $T$  becomes  $T'=Tf$ , and its frequency becomes  $\nu' = \nu/f$ , its pulsation becomes  $\omega' = \omega/f$ .

We know with usual notations that for a black body:

$$N(\omega, T) = \frac{1}{\exp(h\omega/kT) - 1} \quad (27)$$

With  $N(\omega, T)$  average number of photons of pulsation  $\omega$  at the Temperature  $T$  (for one mode).

And the density of Energy of photons whose the pulsation is between  $\omega$  and  $\omega+d\omega$  is  $\rho(\omega, T) d\omega$  with:

$$\rho(\omega, T)d\omega = \frac{(h\omega^3 / \pi^2 c^3)d\omega}{\exp(h\omega/kT) - 1} \quad (28)$$

Let us look for what becomes this density of energy when there is a factor of expansion of  $f$ .

So when there is an expansion of a factor  $f$ , there are 2 modifications:

The first modification is as we saw previously that the photons having an initial pulsation  $\omega$  get a new pulsation  $\omega/f$ .

Moreover a volume  $V$  becomes a volume ( $f^3 V$ ) because of the expansion.

It is important to remember that the density of Energy (28) was obtained multiplying the number of photons in a unity of volume by the Energy of one photon  $h\omega$ .

So to get the new density of energy we first remark that because of the 2<sup>nd</sup> modification, the number of photons in a unity of volume is divided by  $f^3$ .

Moreover, because of the first modification the Energy of each photon is divided by  $f$ .

So the density of Energy of photons with a pulsation between  $\omega/f$  and  $(\omega+d\omega)/f$  becomes:

$$dE' = \rho(\omega, T)d\omega \times (1/f) \times (1/f^3)$$

And with the Equation (28):

$$dE' = \frac{(h\omega^3 / (\pi^2 f^3 c^3))(d\omega / f)}{\exp(h\omega / kT) - 1} \quad (29)$$

If we set  $\omega' = \omega/f$  and  $T' = T/f$ , the density of Energy  $dE'$  of photons of pulsation between  $\omega'$  and  $\omega' + d\omega'$  can be written:

$$dE' = \rho(\omega', T')d\omega', \quad (30) \quad (\text{see Equations (28) and (29)})$$

So we are exactly in the case of a black body at a temperature  $T' = T/f$ : A factor of expansion  $f$  of the internal sphere implies that it keeps properties of a black body, with a temperature decreasing of a factor  $1/f$ . So a factor of expansion  $f$  leads to a temperature:

$$T' = T/f \quad (31)$$

And this is the origin of the fossil radiation according to T.E.

So we interpreted fossil radiation by a different way from General Relativity.

It is possible that the Temperature increases towards the borders of the external sphere because the Energy increases with the distance to the center of the sphere.

So according to T.E, in the fixed Referential (Ether), inside the sphere, the radiation is isotropic, and is exactly the radiation of a Black Body. So if we study this radiation in a Referential linked to the earth, we should be able to obtain the velocity of the earth relative to the Ether, calculating Doppler Effect.

Indeed, experiments measuring fossil radiation have already proved the existence of a Referential in which the fossil radiation is isotropic, and the velocity of the sun relative to this Referential has been found to be approximately 360 km/s, using Doppler Effect.

According to T.E, this Referential is linked to the Ether (fixed) and so this velocity is the velocity of the sun relative to the Ether, and consequently approximately the velocity of the earth relative to the Ether. (We remark that this last velocity of the earth, contrary to the velocity of the sun relative to the Ether, changes during the year, but less than 60km/s, which is small compared with 360km/s).

In fact it is interesting to define an Absolute Temperature which is the Temperature measured in a fixed point of Ether. Then if this Temperature is constant it exists a radiation which is the radiation of a black body at the same temperature relative to the Absolute Referential (Ether).

This last value is in agreement with our previous estimations:

Indeed, we saw in the article (T.Delort, Theory of Ether, Phys.Esays, 13,4(2000), in the Chapter “**4.2.1 Transversal Doppler Effect**”, that the velocity of the earth relative to Ether should be around 300 km/s; But the described experiment should give the exact value which should be the same as for fossil radiation.

Also, the fact that from the earth, we observe an isotropic space by astronomical observations indicates that the earth is near the center of the universe.

It is important to distinguish the massic Ether, which is a matter filling all the space, from the Ether fixed Referential. It is relative to this Ether fixed Referential (presented in **1. INTRODUCTION**) that the velocity of light is equal to  $c$ . Nevertheless, we should expect that there exists some interactions between massic Ether and light.

### **2.3 Heterogeneity of the Universe**

Astronomers discovered that there were some Quasars far away from the earth and blue galaxies less far.

According to the present admitted Theory founded on Relativity, we observe the Universe such that it was when the light was emitted from the observed region, but the Universe is homogeneous. And consequently our region is supposed to have been the same at the time when the light was emitted.

But in fact we do not find traces of blue galaxies or Quasars in our region.

In the Theory of Ether, we have seen that the Universe is not homogeneous, because times, velocities, and Energy of the stars are not the same. This heterogeneity could explain the absence of traces of Quasars or blue Galaxies in our neighborhood.

Nonetheless from the earth, we can observe Quasars and more generally Universe in an isotropic way, as we said at the end of the Chapter **Fossil Radiation**, this is due to the fact that the earth is near the center of the Universe.

Theory of Ether gives also a possible origin to the mysterious  $\gamma$  flashes that we receive and which indicate an enormous release of Energy: They could come from the liberation of mechanical Energy of distant stars that explode. Because according to T.E, those stars have a velocity near from  $c$  and consequently they possess an enormous quantity of moving Energy.

## **3. CONCLUSION**

So we have presented the new Cosmology implied by T.E. It is a drastically new and different approach from the presently admitted Theory founded on General Relativity. Here we obtained many fundamental results of Cosmology in a much simpler way than by G.R. We avoided the use of the Einstein's Tensor and of Riemann geometry, which leads to complex calculations and is also complex (and not very clear) from a purely physical point of view. We interpreted Black Mass, expansion of the Universe, density of the Universe, fossil radiation which can give the velocity of the earth relative to Ether and some other fundamental Cosmological facts.

It should be necessary to compare the velocity of the earth relative to the Ether obtained in the Chapter “*Fossil Radiation*” and the velocity obtained achieving the experiment “Transversal Doppler Effect” described in the article (T.Delort, Theory of Ether , Physics essays, 13,573 (2000)). We have seen that they should be both around 300 km/s.

As a conclusion Theory of Ether implies a new Cosmology which brings many interesting applications. It brings to us a much deepened comprehension of the Universe.

### **Résumé**

Dans un précédent article,nous avons montré la compatibilité de la T.E (Théorie de l’Ether) avec l’ensemble des expériences concernant la Relativité Restreinte et la Physique Quantique.Ici, nous poursuivons l’étude de la Cosmologie par la T.E . Ainsi on montre que la T.E interprète le décalage résiduel obtenu par ces expériences. En Cosmologie, elle interprète notamment la Masse Noire, la densité de l’Univers .On obtient aussi utilisant le rayonnement fossile la vitesse du soleil par rapport à l’Ether.

Nous montrons que la T.E propose une conception de la Cosmologie de l’Univers beaucoup plus claire et simple que la Relativité d’EINSTEIN. Ainsi , elle évite l’emploi de la Géométrie Riemannienne.

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