THEORY OF DARK MATTER AND DARK ENERGY-ANNEX A

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ABSTRACT:

In a first article [(1)] we have exposed a Theory of Dark matter and a Theory of Dark energy. In this article we are going to bring complements to each of the 2 theories. Concerning the Theory of dark matter, we are going to study the flat rotation curve of galaxies with a flat rotation curve close to the centre of those galaxies (r close to 0), and then the collisions between dark matter and baryonic matter. We will also show how obtaining the Tully-Fisher's law taking into account the plasma constituting the Inter Cluster Medium (ICM). Concerning the Theory of dark energy, we are going to study the phenomena in the early Universe that are the origin of the great structures observed today.

I.INTRODUCTION

In a preceding article [(1)], we have exposed a Theory of dark matter and a Theory of dark energy. In this article we are going to expose complements to each of those theories. This article will contain 2 main sections, the 1st section exposing some complements to the Theory of dark matter and the 2nd one complements to the Theory of dark energy. Concerning the complements to the Theory of dark matter we will study: 1)The rotation curve of the galaxies with a flat rotation curve in the neighbourhood of the centre of those galaxies. 2)The collisions between dark matter and dark energy. 3)The baryonic Tully-Fisher's law taking into account the Inter Cluster Medium. Concerning the Theory of dark energy we will study in the early Universe the phenomena that are the origin of the grear structure of the Universe that can be observed today.

II)COMPLEMENTS TO THE THEORY OF DARK MATTER.

1)THE ROTATION CURVE OF GALAXIES WITH A FLAT ROTATION CURVE FOR r CLOSE TO 0.

In the article [(1)], we have shown that a solution to the equation of equilibrium of a spherical concentration of dark substance was a density in $1/r^2$, r being the distance to the centre of the sphere. So for r=0 we obtain an infinite density which is impossible. Consequently our solution in $1/r^2$ can be valid only approximately. We remind that in Cosmology, the quasi totality of models are valid only approximately (formation of the earth, of stars, constitution of the sun..)

In order to predict the rotation curve close to r=0, we have the following explanation:

-For r close to 0 we have a new phenomenon not taken into account in our model of concentration of dark matter. The simplest phenomenon would be the following:

We have seen that dark substance had a tendency to be homogeneous. This tendency explained that the density of dark substance in the Universe is homogeneous except in the spherical concentrations of dark substance constituting galaxies with a flat rotation curve (But it could exist other models).

It is very possible that even in the spherical concentrations of dark substance, for a density ρ superior to a density $\rho_M(T)$ ($\rho_M(T)$ possibly depending on the temperature T of the

dark substance), then we have also the preceding effect of homogenisation that predominates and cancels the effect of gravitational attraction. We then obtain a density $\rho(r)$ verifying:
It exits a distance d_0 (very small relative to the dimensions of the spherical concentration of dark substance), such that:
-For $r<d_0$ $\rho(r)$ is constant and equal to $\rho_M(T)$
-Fot $r>d_0$, $\rho(r)$ is the solution of the same equation of equilibrium that we obtained without taking into account the previous phenomenon of homogenisation of dark substance. We then obtain that $\rho(r)$ is a decreasing function of r and that for r sufficiently great (r superior to a distance d_1) $\rho(r)$ is approximately equal to the density obtained without taking into account the phenomenon of homogenisation of dark substance, meaning that $\rho(r)$ is in $1/r^2$.

Then we obtain easily that the preceding density $\rho(r)$ is in agreement with the experimental curve of velocities, meaning that for r very close to 0 v(r) is also very close to 0, then v(r) increases and reaches a value V, then v(r) remains approximately constant and equal to V, V being the predicted value of the model not taking into account the phenomenon of homogenisation of dark substance. We could improve this model taking into account baryonic matter, then we should obtain the observed fluctuations of v(r) for great r and improve the prediction of v(r) for r close to 0.

2)THE COLLISIONS BETWEEN DARK MATTER AND DARK ENERGY.

We remark that collisions between dark matter and baryonic matter have never been observed, despite that it is well established that there is plenty of dark matter inside galaxies with a flat rotation curve and inside galaxy clusters. But this is well-explained by our Theory of dark matter: Indeed according to this Theory, dark matter is a substance constituting what is usually called "emptiness" and behaves as absolute emptiness concerning the displacement of baryonic particles. Consequently our Theory of dark matter predicts that collisions between dark matter and baryonic matter are impossible, in agreement with astronomical observations.

3)THE INTER CLUSTER MEDIUM AND THE BARYONIC LAW OF TULLY-FISHER.

The astronomic observations have shown the existence inside galaxy clusters of a plasma constituted of baryonic particles, called Inter Cluster Medium (ICM). This plasma constitutes an important part of the mass of a cluster, that is generally greater than the total mass of the galaxies contained by this cluster.

Moreover in order to obtain the baryonic law of Tully-Fisher, we have considered that each baryonic particle belonging to the dark halo containing a galaxy with a flat rotation curve transmitted thermal energy to the dark substance constituting this dark halo. Consequently if the previous hypothesis was true we could not anymore obtain the baryonic Tully-Fisher's law despite that this law is in agreement with astronomical observations.

The explanation is the following: The ICM is mainly constituted of ionised particles, generally hydrogen or helium. The baryonic law of Tully-Fisher remains valid if we admit that a baryon belonging to a charged particle, for instance a ionised particle, then it does not transmit thermal energy to the dark substance.

Astronomical observations have shown that the baryonic particles constituting the ICM own a very high temperature and do not cool. The previously admitted hypothesis explains also the previous observed phenomenon.

III)COMPLEMENTS OF THE THEORY OF DARK ENERGY.

1)THE EARLY UNIVERSE.

According to the Standard Cosmological Model (SCM), the galaxies, the stars and more generally the great structures of the Universe that can be observed today have been formed because of some heterogeneities in the density of the early Universe. Nonetheless, if we estimate the heterogeneities of baryonic matter in the early Universe, they are greatly much too low in order to explain the great structures of the Universe observed today. So generally, the SCM admits that those heterogeneities were due to dark matter.

According to our Theory of dark matter [1], we admitted that because of the expansion of the Universe, we must take as density of dark substance in P $\rho(P)=0$ if P does not belong to a concentration of baryonic matter or dark matter. This rule was easy to apply in the present Universe (We take $\rho(P)=0$ if P does not belong to a galaxy cluster nor to a galaxy with a flat rotation curve). But in the early Universe, the Universe was filled with baryonic matter with a density approximately homogeneous and consequently we cannot apply the previous rule.

In order to explain the great structures of the Universe observed today with our Theory of dark matter, we therefore must find new laws, compatible with the previous rule, permitting to define the density of dark substance that we must take in Newton's equations when the Universe is approximately homogeneous in baryonic matter. But we can also introduce a new phenomenon, that is a tendency of baryonic matter to concentrate in the local Cosmological frame to which it belongs (We remind that we identified this frame with the CMB rest frame). The previous phenomenon is in agreement with astronomical observations according to which stars end galaxies have velocities small relative to c measured in the local Cosmological frame to which they belong. This phenomenon could not exist in the MSC according to which it does not exist special frame (Despite that astronomical observations show that the CMB rest frame is a special frame).

Generalizing the rules of adaptation in the Newtonian equations that we admitted in the case of the concentration of baryonic matter constituting galaxy clusters, we can propose the following phenomena in the primordial Universe:

Just after the formation of baryonic particles, the Universe is filled with baryonic matter and dark substance, both with a density quasi homogeneous. Moreover, the dark substance is at rest in the local Cosmological frame to which it belongs and, P being a point of the Universe, if $\mathbf{V}_{BM}(P)$ is the mean velocity in vector measured in the local Cosmological frame whose the origin is P of the baryonic particles in the neighbourhood of P, then the norm of $\mathbf{V}_{BM}(P)$ is nil or very small relative to c. Then generalizing the rules of adaptation of the Newtonian equations, because of the expansion of the Universe, we must take densities of baryonic matter and of dark substance equal to 0 in the Newtonian equations (written in the local Cosmological frame that we identified with the CMB rest frame), and consequently we obtain a gravitational field and a gravitational potential equal to 0 in all local Cosmological frames at any point of the Universe.

Then because of heterogeneities of baryonic matter, some concentrations of baryonic matter are constituted, with densities sensibly higher than the density of the medium surrounding them, whose the densities of baryonic matter and of dark substance are quasi-homogeneous. Then because of the rules of adaptation of the Newtonian equations, we must take at each point belonging to those concentrations of baryonic matter a density of dark matter equal to the density of the dark substance ρ_0, which is very high, in the Newtonian equations (written in the local Cosmological frame that we identified with the CMB rest frame) in order to obtain the gravitational field and the gravitational potential. Consequently this phenomenon amplifies greatly the phenomenon of concentration of baryonic matter that is the origin of the great structures observed today (Formation of stars, galaxies, galaxy clusters, super clusters).

We remark that the previous phenomenon could be the origin of the tendency of concentration for baryonic matter in the local Cosmological frame to which it belongs, tendency that we admitted previously without giving its explanation nor its mechanism.

IV)CONCLUSION

So we brought important complements to our Theory of dark matter and Theory of dark energy. For instance we have seen that introducing a phenomenon of homogenisation of dark substance inside spherical concentrations of dark substance we obtained the rotation curve of galaxies with a flat rotation curve close to their centre (r close to 0). We also justified why collisions between dark matter and baryonic matter were impossible, which was confirmed by astronomical observations. Finally we justified why the baryonic Tully-Fisher's law could remain valid even if we took into account the ICM. Concerning our Theory of dark energy, we have seen that we needed to take into account a new phenomenon in the early Universe in order to justify the great structures observed today. This new phenomenon was a tendency of baryonic matter to concentrate in the local Cosmological frame to which it belongs, this phenomenon being in agreement with present astronomical observations.

V)REFERENCES

1)Theory of dark matter and dark energy, Thierry DELORT, open archives VIXRA (www.vixra.org), INTERNET ARCHIVE (www.archive.org), HAL. Livre Théories d'or 9e edition, Editions Books on Demand, Paris (2017).