# Janus Cosmological Model and the Fluctuations of the CMB

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It is shown than, in the framework of the Janus Cosmological Model the gravitational instability which occurs in the negative sector makes an imprint in the positive one, which corresponds to the CMB inhomogeneities. So that their characteristic wavelength gives the ratio of the space scale factors of the two sectors, which differ from two orders of magnitude. Subsequently the speed of light in the negative sector is ten times highers than ours. So that, given to distant points, if the travel between them is managed along the negative geodesics paths, the corresponding travel time is reduced by a factor one thousand.

## 1 Introduction

A cosmological model must take account of the observations. From this point of view a recent paper [1] showed that the the Janus Cosmological Model (JCM) fits many.

- JCM explains the absence of observation of the so called primeval antimatter, opposite to the mainstream $\Lambda CDM$ model.
- JCM describes precisely the nature of the invisible components of the universe, opposite to the mainstream $\Lambda CDM$ model.
- JCM predicts that the antimatter produced in laboratory will react as the matter with respect to the gravitational field of the Earth (it will fall).
- Because positive and negative matter are repelling each other, the negative matter in the solar system is almost zero. So, JCM fits the classical relativistic observation, as presented in former papers [2, 3].
- JCM suggests a clear schema for VLS formation [4] when the mainstream model $\Lambda CDM$ seems to struggle to give one.
- JCM explains the observed strange effect due to the Great Repeller [5]. The measured escape velocities of galaxies are due to the presence of an invisible repellent cluster made of negative mass, located in the centre of the big void. The mainstream model supporters suggest that such a repellent effect could be due to some kind of a hole in the dark matter field of the universe (positive masses). But, if the gravitational instability leads to the setting up of massive clusters, it does not provide ant scheme for such void formations. So that the mainstream model $\Lambda CDM$ does not provide any explanation of the observation.
- JCM explains the confinement of galaxies and their flat rotation curves [1, 6]. Mysterious dark matter is no longer required, while the mainstream model $\Lambda CDM$ does.
- After JCM the intensity of the observed gravitational lensing effect is mainly due to the negative matter that surrounds galaxies and clusters of galaxies. Mysterious dark matter is no longer required, while the mainstream model $\Lambda CDM$ does.
- JCM suggests an explanation of the low magnitude of very young galaxies: this would be due to the negative lensing weakening, when their light are crossing the negative mass clusters located at the center of the big voids.
- JCM explains the spiral structure of galaxies, due to dynamical friction with the surrounding mass [1, 6]. The model $\Lambda CDM$ don't give any model explaining the spiral structure.
- JCM explains the acceleration of the universe [1]. The so-called dark energy is the one associated to the negative mass content through $E = \rho c^2$, with $\rho < 0$.
- JCM explains the homogeneity of the primeval universe [2, 16].

JCM is definitively not a simple or pure product of mathematical physics. But it represents a deep paradigmatic change, on geometrical grounds. In the Einstein's model the universe is considered as a manifold, whose geometry corresponds to a single metric field , solution of a single field equation, without cosmological constant:

$$R_{\mu\nu} - \frac{1}{2}\, R\, g_{\mu\nu} = \chi T_{\mu\nu}\ . \tag{1}$$

Such model automatically generates the unmanageable runaway effect [7, 8], just because, if imbedded in a given gravitation field (the term $T_{\mu\nu}$), positive and negative masses react the same way (a single metric solution $g_{\mu\nu}$). If we give up such restrictive and non-logical hypothesis it means that, imbedded in a given gravitation field the geodesics of the two species derive from two metrics fields $g^{(+)}_{\mu\nu}$ and $g^{(-)}_{\mu\nu}$ , solutions of two coupled field equations, as derived from Lagrangian method [9, 10].

$$\begin{aligned} R^{(+)}_{\mu\nu} - \frac{1}{2}\, R^{(+)}\, g^{(+)}_{\mu\nu} &= +\chi \left( T^{(+)}_{\mu\nu} + \sqrt{\frac{g^{(-)}}{g^{(+)}}}\, T^{(-)}_{\mu\nu} \right), \\ R^{(-)}_{\mu\nu} - \frac{1}{2}\, R^{(-)}\, g^{(-)}_{\mu\nu} &= -\chi \left( T^{(-)}_{\mu\nu} + \sqrt{\frac{g^{(+)}}{g^{(-)}}}\, T^{(+)}_{\mu\nu} \right). \end{aligned} \tag{2}$$

The physical meaning of the presence of the two square roots in the second members is the energy conservation requirement. We have a single manifold $M_4$, with two tensor fields $T^{(+)}_{\mu\nu}$ and $T^{(-)}_{\mu\nu}$, which refer to positive and negative mass contents. In some regions $T^{(+)}_{\mu\nu}$ dominates, in other $T^{(-)}_{\mu\nu}$ dominate. In others the two are zero. In any case we find everywhere two families of geodesics, as derived from the metric $g^{(+)}_{\mu\nu}$ and $g^{(-)}_{\mu\nu}$. The first refers to the paths of positive mass particles, and positive energy photons (null positive geodesics). The second refers to the paths of negative mass particles, and negative energy photons (null negative geodesics).

On pure geometric grounds the negative mass objects are invisible to us, because they emit negative energy photons that positive mass devices cannot capture. And vice versa. The positive and negative masses interact only trough (anti) gravitation.

The classical Newton's law comes from the Einstein's equation (1) through Newtonian approximation (small curvature, velocities small with respect to the speed of light, quasi Lorentzian metric).

Similarly from the system (2) we get [3, 11] the following Newtonian, and antinewtonian interaction laws:

- Positive masses do attract together, through Newton' law;
- Negative masses do attract together, through Newton's law;
- Opposed masses do repel each other, through anti Newton's law.

This interaction scheme fits the action-reaction principle.

The nature of the invisible components of the universe are determined from dynamic group theory [6, 12]. They are a copy of the ordinary antiparticles, with negative energy. This schema fits initial Sakharov's idea [13–15].

As evoked in [17], JCM may produce an original scheme for galaxies' formation. The structures of the positive and negative sectors are fairly different. After discoupling, with $\rho^- \gg \rho^+$, spheroidal globular clusters form first, the matter being confined in the remnant place, getting an alveolar structure. The compression of positive matter along flat structure is optimum for radiative cooling and Jeans' instability triggering, giving galaxies, stars and heavy atoms. At the contrary the negative mass antimatter is confined in spheroidal objects, that can be compared to huge proto-stars that will never ignite because their cooling time is longer that the age of the universe. As a consequence no galaxies, no stars, no heavy atomes and planets can form. Life is absent from such negative world.

## 2 A short remark about another model with negative mass

The model of L. Blanchet and G. Chardin is based on the Einstein's equation, so that the runaway effect belongs to it, which does not worry the authors.

Their scheme suggests, without theoretical grounds, that the primeval antimatter could have a negative mass.

From the Einstein's equation the interaction laws between positive and negative masses is the following (which contains the runaway effect):

- Positive masses mutually attract through the Newton's law;
- Negative masses mutually repel through "anti-Newton's law";
- Positive masses are repelled by negative masses;
- Negative masses are attracted by positive masses;

which contradicts the action-reaction principle. Howevever L.Blanchet and G.Chardin think that, thanks to such interaction scheme the primeval (negative mass) antimatter could have survived somewhere.

About cosmological evolution the authors opt for the Dirac-Milne model [17], which corresponds to a constant null gravitational field, with a constantly global zero mass. Then the expansion is linear in time, which contradicts the recent observation of the acceleration of the expansion.

JCM shows that there are two forms of antimatter. The positive mass, we can call it "Dirac antimatter" (C-symmetrical of our matter) reacts as the ordinary matter, if imbedded in a gravitational field This is the antimatter we produce in laboratory, so that we predict that the antimatter weighted if the alpha experiment will fall down.

The negative mass antimatter corresponds to the primeval antimatter and is located between galaxies. We may call it "Feynmann antimatter" (PT-symmetrical from our ordinary matter).

## 3 How to determine the parameters in the negative sector

According to the "variable constants" evolution schema [2, 16] the two sectors correspond to two different sets of so-called constants, time plus scale parameters:

$$\begin{gathered}\left\{c^{(+)};\ G^{(+)};\ h^{(+)};\ e^{(+)};\ m^{(+)};\ \mu_0^{(+)};\ a^{(+)};\ t^{(+)}\right\},\\ \left\{c^{(-)};\ G^{(-)};\ h^{(-)};\ e^{(-)};\ m^{(-)};\ \mu_0^{(-)};\ a^{(-)};\ t^{(-)}\right\}.\end{gathered} \tag{3}$$

Where are space and time factors. In both sectors the so-called constants and space and time factors experience "joint gauge variations" which keep the equations of physics invariant. It means that if one chooses one of the eight parameters the other seven can be expressed using that one. For example:

$$\begin{gathered}c^{(+)} \propto \frac{1}{\sqrt{a^{(+)}}}\,, \quad G^{(+)} \propto \frac{1}{a^{(+)}}\,, \quad h^{(+)} \propto (a^{(+)})^{3/2}\,,\\ e^{(+)} \propto \sqrt{a^{(+)}}\,, \quad m^{(+)} \propto a^{(+)}\,, \quad t^{(+)} \propto (a^{(+)})^{3/2}\,;\\ c^{(-)} \propto \frac{1}{\sqrt{a^{(-)}}}\,, \quad G^{(-)} \propto \frac{1}{a^{(-)}}\,, \quad h^{(-)} \propto (a^{(-)})^{3/2}\,,\\ e^{(-)} \propto \sqrt{a^{(-)}}\ \ ; \quad m^{(-)} \propto a^{(-)}\,, \quad t^{(-)} \propto (a^{(-)})^{3/2}\,.\end{gathered} \tag{4}$$

What is the ontological justification of such process? It makes no necessary to invoke inflation to justify the observed homogeneity of the primeval universe. In effect, the cosmological horizon becomes an integral [2, 16]:

$$horizon^{(+)} = \int c^{(+)}\, dt^{(+)} \propto a^{(+)}. \tag{5}$$

Same thing in the "negative sector".

A question arises immediately: when does this generalized gauge process era ends? This will be examined in a next paper.

Have a look on the Jeans' lengths $L_J^{(+)}$ and $L_J^{(-)}$ and times Jeans $t_J^{(+)}$ and $t_J^{(-)}$. In this gauge process all the velocities, including thermal velocities, vary like the speed of light of their corresponding sector:

$$\langle V^{(+)} \rangle \propto c^{(+)}\,, \qquad \langle V^{(-)} \rangle \propto c^{(-)} \tag{6}$$

so that

$$\begin{aligned} L_J^{(+)}\,, &\simeq a^{(+)}\,, \qquad & t_J^{(+)} &\simeq t^{(+)}\,, \\ L_J^{(-)}\,, &\simeq a^{(-)} & t_J^{(-)} &\simeq t^{(-)}\,. \end{aligned} \tag{7}$$

The fluctuations, due to gravitational instability are not observable in a given sector, by observers who live in.

Anyway, in a fully ionized plasma the strong link to the radiation backgrounds prevents clustering of matter in both sectors. What about the "gas of photons"?

## 4 Photons react to gravitational field

This gives the gravitational lensing effect. On another hand the photons contribute to the curvature. If the inertial mass of the photon is zero, we can introduce an individual equivalent gravitational mass of the photon:

$$\begin{aligned} m_\varphi^{(+)} &= \frac{h^{(+)}\, v^{(+)}}{c^{(+)2}} \propto a^{(+)} \propto m^{(+)}\,, \\ m_\varphi^{(-)} &= \frac{h^{(-)}\, v^{(-)}}{c^{(-)2}} \propto a^{(-)} \propto m^{(-)}\,. \end{aligned} \tag{8}$$

We may consider than the gravitational instability occurs in the "gaz of photons" but the corresponding Jeans' length becomes:

$$\begin{aligned} L_J^{(+)} &= \frac{c^{(+)}}{\sqrt{4\,\pi\, G^{(+)}\, \rho^{(+)}}} \simeq a^{(+)}\,, \\ L_J^{(-)} &= \frac{c^{(-)}}{\sqrt{4\,\pi\, G^{(-)}\, \rho^{(-)}}} \simeq a^{(-)}\,, \end{aligned} \tag{9}$$

again, such fluctuations in one sector cannot be observed by an observer that belongs to, because it extends beyond the corresponding cosmological horizon. But, from a conceptual point of view, this links to the idea of so-called "multivers". Beyond our cosmological universe we may consider that other "universes" extend, with different sets of physical constants and scale factors. But, as such they should obey the same equations, their histories would not be different from ours, giving, in the corresponding positive sectors, atoms, stars, galaxies, planets and life.

We get an infinite set of coupled (positive/negative mass) portions of the universe.

If the gravitational instability cannot occur in our sector of the universe, before decoupling, we have the imprint of such primeval instability, which occurs in the negative sector. We think that this produces the light inhomogeneities in the CMB.

The basic fluctuation extent is two order of magnitude smaller than the whole angular extent. It gives directly the order of magnitude of the ratio of the space scale factoirs. In the negative sector the fluctuations have a characteristic wavelength, so that the measure of the imprints in our sector gives the order of magnitude according to:

$$\frac{a^{(-)}}{a^{(+)}} \approx \frac{1}{100}\,. \tag{10}$$

As a conclusion, if we consider two points A and B of the manifold, we have two different lengths, which differ from the same ratio.

## 5 Link to the interstellar travel problem

During the gauge process era the two sectors experience evolution of their constants according to:

$$a^{(+)}\, c^{(+)2} = a^{(')}\, c^{(')2} = constant. \tag{11}$$

Combining with (10) we get:

$$\frac{c^{(-)}}{c^{(+)}} \approx 10. \tag{12}$$

According to the Einstein's model (1), interstellar travels at sub-relativistic velocity implies durations fairly incompatible with human lifetime. But if some distant civilizations could invert the mass of a vehicle (plus passengers) and travel along geodesics of the negative sector at $V^{(-)} < c^{(-)}$ the gain in time travel would correspond to three order of magnitude. So that a travel to, or from the nearest systems could be possible.

## 6 Conclusion

We review the many observational confirmations of the Janus Cosmological Model. We deal with the origin of the fluctuations in the CMB. Based on our primeval gauge process era, which explains the homogeneity of the primeval universe, without need to the inflation schema, we look at the gravitational instability during that era and show that the corresponding Jeans's length follows the extension of the cosmological horizon in both sectors. We notice that, even if we cannot make observation beyond the horizon, other portions of the universe could be ruled by different sets of so-called constants and scale factors. This links to the idea of "Multiverse". But, according to ou scheme such sets should derive from the same set of equations, so that the physical, an biological evolution in such sectors should give the same patter (atoms, stars, planets, life).

We point out that such primeval gravitational instability, occurring in the negative sector, make an imprint in ours, and that corresponds to the observed fluctuations in the CMB.

Then it gives the measure of the ration of the two scale factors $\frac{a^{(+)}}{a^{(-)}} \approx 100$.

According to our gauge process scheme it corresponds to $\frac{c^{(-)}}{c^{(+)}} \approx 10$.

As a conclusion it shortens the travel time, for sub-relativist journeys, by a factor 1000, which makes the impossibility of travels to nearest stars questionable, if mass inversion technique would be someday possible.

Submitted on September 26, 2018

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