ARCADE 2 EXTRAGALACTIC EMISSION AND DARK MATTER AS SEEN BY THE THEORY OF RELATION

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ABSTRACT

In 2006, Alan Kogut and his colleagues from the Goddard Space Flight Center, searching for signs of heat from the first generation of stars with the balloon-borne Arcade 2 equipped with sophisticated radiometers, discovered instead an intense radio emission that nobody had still detected, that no physical model had foreseen the existence, and which results from none of the known sources in the Universe. This cosmic background noise has an intensity of synchrotron emission estimated six times higher than the combined radio of all radio sources in the known universe. Our hypothesis is that this radio emission of extragalactic source is the residue of a huge energy burst soon after the recombination triggering simultaneously the formation of first stars and the reionization. Under the theory of Relation, it is the vestige of a sudden release of energy from a relativistic *bang* via a Lorentz energetic transformation, which fills an energy-matter deficit, and generates both the birth of primordial stars and the reionization of neutral gas. This extra ordinary matter would replace the hypothetical cold dark matter theorized to be the missing primitive matter initiating large structures.

Keywords: Arcade's cosmic radio background - Relativistic Big Bang - Relativistic bang - Relativistic proton - Energetic transformation of Lorentz - Compensation cold dark matter (CCDR) - Cosmic static - Cosmic background radiation (CBR) - Cosmic microwave background (CMB) at 3 kelvins (K)

1. INTRODUCTION

In 2006, Alan Kogut and his colleagues of NASA's Goddard Space Flight Center, searching the sky for heat from Population 111 stars formed about 13 billion years ago, discovered a mysterious cosmic radio noise that booms six times louder than expected [1]. The researchers based their findings on 2.5 hours of data gathered during the flight of a stratospheric balloon with seven radio receivers called ARCADE 2 (Absolute Radiometer for Cosmology, Astrophysics, and Diffuse Emission) [2, 3]. This instrument is designed to measure the temperature of the cosmic microwave background at centimetre wavelengths and to search for deviations from a blackbody spectrum resulting from energy releases in the early universe. It covered about 7 percent of the sky.

ARCADE's radio receivers for the balloon flight were the first detectors capable of identifying the mysterious radio-noise signals. They were cooled to a temperature just 2.7 degrees above absolute zero, the same temperature as the cosmic microwave background (CMB) radiation, in order to not contaminate the cosmic signal by the instrument's heat. No physical model had predicted the existence of a so intense background hiss of radio noise, and it results from no known radio sources in the Universe.

On its July 2006 flight the large helium-filled balloon launched from NASA's Columbia Scientific Balloon Facility in Palestine, Texas, flew to the edge of the Earth's atmosphere to an altitude of 36 km. The aim was to measure the spectrum of the CMB at centimetre wavelengths by hoping to detect the signature of star formation or the decay of the hypothetical dark matter particles that make up 25 percent of nature and that form the scaffolding for galaxies [4, 5, 6]. When the researchers get back the instrument and analyse the results, instead of the expected faint signal, it was a real uproar which recorded the detector. The researchers thought at first of a problem of grading of devices and verified their data during almost one year. The noisy signal being always imperative, they compared the data collected by Arcade with the recordings brought back by the other missions and found the signs of their radiation. It was hidden, because the devices of the other astrophysicists had no the adequate calibration. It was thus by a real stroke of luck that the unexplained residual signal appeared significantly in the range of frequencies studied by Arcade.

During long months, the American researchers formulated unsuccessfully hypotheses on known radio sources in the Universe [7]. The first one implied the solar magnetopause, the border of the region dominated by the magnetic field of our star, which sends us any sorts of radiations. Because the magnetopause is not symmetric, the emission should have been very different according to the angle under which we look at it, what is not the case. The second implied the radiogalaxies. By accelerating electrons by their magnetic fields, these galaxies emit radio radiation in great quantities. The most powerful were listed, and even by taking into account the sum of other, more discreet and more numerous, their accumulated brightness is six times less intense than the signal of the radiation collected by Arcade. The last candidate is the most intense of the radio sources: our own galaxy. Dusts, atoms and particles of the intragalactic environment, slowed down by gases or accelerated by magnetic fields, bombard us with radio radiations. The galactic emissions are influenced by the electric and magnetic fields which cover the Milky Way, and even if this influence were the same everywhere the observed radiation would be yet too intense to originate from our galaxy

Still the researchers of the Nasa have no idea where this cosmic static is coming from, wait that their data are examined closely and dash on new tracks. To date, there is no plausible explanation for the unclassifiable observed radio source but it is clear that it is too intense to come from our galaxy: it would be extragalactic.

In this paper, we suggest that the unexpected radiation detected by arcade 2 is a secondary cosmic background from a relativistic bang slightly less than 100 million years (Myr) after the Big Bang, whose energy has led to the birth of primordial stars and the reionization of neutral gas. The paper is organized as follows: Sec. 2 shows that with simulation astronomers establish the age of the first stars between 30 and 100 Myr after the Big Bang. They postulated the existence of a gravitational exotic cold dark matter because there was not enough time to condensate during the early expansion. Instead, the theory of Relation asserts that Arcade 2 microwave radio-noise source implies a huge energy of ordinary matter liberated by a relativistic bang, which gives gravity the necessary energy-mass to start the contraction. Sec. 3 stresses that although the early history of reionization is still regarded as posterior to the formation of primordial stars, we rather think that neutral gas in the intergalactic medium were reionized at the same time that the first stars were formed, due to the energy brought by the relativistic bang. Sec. 4 examines, through the theory of Relation, the relativistic bang which, via an energetic transformation of Lorentz, liberates a huge energy that we speculate to be the source of the strong radio noise power discovered by the NASA researchers. This energetic transformation of Lorentz started simultaneously the first star-forming system from the dense gases and the reionization of less dense neutral gases. Sec. 5 concludes that if we replace the hypothetical cold dark matter to fashion the first stars by an enormous liberation of energy from a relativistic bang, it would correspond to the loud microwave radio noise discovered by Arcade 2 and it could be the spark plug igniting contemporaneously the formation of massive stars and the cosmic reionization.

2. FIRST STARS

One of the great problems concerning the formation of the first stars is that there was not enough time to condensate during the early expansion. Once this first phase of passing from a pure homogeneity to small regions of overdensity is done, the second phase is easy: overdense regions attract towards them the surrounding matter by their field of gravity, the primeval inhomogeneities get closer increasing their high density and the attractive power produces a snowball effect. The contraction could start after the recombination (380 000 yr;   3 000 K), with a gravity able of fighting the general movement of the expansion and the thermal pressure, but unable to double the local density in a sufficient time that would allow to realize the current large scale structure in the universe.

To solve this problem of too little time, the astronomers postulated the existence of a gravitational, exotic, dark matter. The admitted supposition is a cold dark matter; cold because it is a heavy, slow, unknown particle; dark because it cannot be observed by electromagnetic radiation. This particle would not be neutralized by photon as ordinary matter, what would have the effect of condensing overdense exotic pockets without perturbing the isothermal process. The ordinary matter being so attracted, the seeding of stars and galaxies is accelerated [8].

As for us, we presume that dark matter was in small quantity at the beginning of the expansion, accumulated over time to become what is observed today. There was mostly ordinary matter with some hot dark matter, like the neutrino, unable to play at this early time the role assigned to the cold dark matter [9]. We ruled out an exotic cold dark matter standing there since the Big Bang, waiting to be recuperated to make the first stars. We assume that the Big Bang was relativist and that it is a relativistic bang soon after the recombination that contributed to liberate a huge energy of ordinary matter, cooling the expansion and giving to the gravitation the necessary energy-mass to start the contraction. This bang would correspond to the discovery of Arcade 2 and would have, at the same time, allowed to condense the primordial dense gases to form the first stars and to begin the reionization of the least dense neutral gases.

For the present universe, however, the theory of Relation uses CCDM (compensation cold dark matter) model in which the total density is equal to the density of the ordinary matter plus dark matter but lower than the critical density. The difference between the total density and that of the ordinary matter plus dark matter is fulfilled along the cosmological time by an expansionist spacetime wave which transforms its negative energy into positive energy. This decelerating expansionist spacetime wave constitutes the dark energy. Until the critical density is reached, this process could be assimilated to a continuous creation of positive matter which is immediately condensed to become ordinary matter and dark matter.

Astronomers utilize numerical cosmology simulating the formation of galaxies and clusters of galaxies, and they operate the same numerical and physical approaches to study the first structures forged after the Big Bang. The dominant position is that in a flat Cold Dark Matter model with $\Omega \simeq 0.3$ that agrees with present large-scale structure observations, the oldest stars in the Milky Way should have formed in the first halos where gas was able to cool with the high peaks of the density field collapsing on scales of ~ $10^7 M_\odot$, at redshift (z) ~ 20, ~ 200 Myr after the Big Bang [10]. The Jeans mass, minimum mass that a quantity of gas must have to collapse under its gravity, is proportional to the square of the gas temperature and inversely proportional to the square root of its pressure [11]. Because the temperatures of the first collapsing gas clumps were almost 30 times higher than present-day molecular clouds, the jeans mass of the first star-forming systems would have been almost 1 000 times larger [12]. The differentiation of matter into galaxies and stars could have begun when such a "Jeans mass" was obtained and it seems clear that it would form massive stars. More than ten years ago the first simulations of the formation of the first objects which compute the formation of the molecular hydrogen, with high enough resolution to identify the site where the cooled gas concentrates to form stars, have been performed. These simulations show that once the gas cools fast enough, it becomes self-gravitating and makes a cooling flow in the halo center (notice that because of the rapid merging rate there should often be several "halo centers" or density peaks in a given collapsed object). Obviously the gas at the center cools fastest and will collapse first. At the center of the cooling flow, the cloud becomes optically thick and fully molecular by three-body reactions, on a time short compared to the evolutionary timescale of the halo, and this should cause the rapid cooling and collapse of a central core with a mass of 100 to 1 000 $M_\odot$. As long as the formation of stars does not release much energy, gas will continue to cool and accumulate in the center, and continued accretion of more gas at the bottom of the potential cannot be stopped until a sufficiently massive star is manufactured to heat and expel the gas around it. Massive stars should eventually forge first in the center of this cooling flow. It has been generally assumed that Population 111 stars formed at $z \sim 20$ [10]. The first star-forming clumps were much warmer than the molecular gas clouds in which most stars currently form. Dust grains and molecules containing heavy elements cool the present day clouds much more efficiently to temperatures of only about 10 K. By rapid fragmentation without heavy elements and magnetic fields maybe low-mass stars were fabricated at the same time as the first massive stars [13]. These first stars were probably not sufficient of themselves to reionize the Universe, but they could locally ionize the medium, and on going supernova served the important role of polluting it fairly extensively with heavy elements, which allowed the next generation stars to form more easily [14].

That being said on predominant position, the simulations, sometimes contradictory, tend to put off in the time the formation of first stars. On one hand, experts from the US Department of Energy's (DOE) SLAC National Accelerator Laboratory, the Michigan State University, and the Stanford University have recently managed to use computer models to simulate the way in which the first *twin* stars in the very early Universe were shaped. Stretching as far back as 200 Myr after the Big Bang, the model reveals the Population III stars were not nearly as massive as first suggested, and that they have been hardly originally formed by themselves in star systems [15]. The initial conversion of gas into stars was highly inefficient and produced a very small number of stars. Probably less than 1 percent of the gas in these primordial clouds actually cooled and collapsed to sufficiently high densities to form stars.

On the other hand, researchers use more and more cold dark matter to compensate for the shortage of ordinary matter. Although there are many unknown parameters, such as the quantity and type of dark matter forming the bulk of the mass of the Universe, they consider that the differentiation of matter into galaxies and stars could have begun when "Jeans mass" was obtained as little as ~ 30 Myr after the Big Bang corresponding to z ~ 65 [11]. The cosmic temperature was low enough for electrons to be captured into atoms and for gravitation to overcome the enormous pressure of matter and the associated radiation [16]. At this time the overdense regions contained about 10^5 $M_\odot$ and Population 111 massive stars may have been formed.

Consequently, there are presently a number of contenders for a theory to explain the origin of galaxies and large-scale structure in the Universe, but no single model can fit all the observational data with the theoretical calculations of the distribution of matter produced by the action of gravity on small initial density fluctuations in the expanding Universe. Our hypothesis is that the shortage of ordinary matter is fills up by an enormous quantity of matter- energy brought by a cosmological event connected to the discovery of Arcade 2.

Nasa considers that the spectrum of radio noise power, at a level estimated at six times higher than the combined radio emission from all known radio sources in the universe, is consistent with the one produced by radio galaxies via charged particles spiraling in a magnetic field, which thereby emit radio noise through synchrotron emission. This loud microwave radio noise is not accompanied by infrared thermal emission as in the case of well-known radio galaxies, but it is accompanied by Bremsstrahlung emission radio noise, which is caused by the deceleration of electrically-charged relativistic particles during collisions. The researchers are convinced the noise source does not match any known pattern from sources in the Milky Way and is not from distant galaxies or from decaying particles of exotic dark matter.

Our approach is that the above features and characteristics are also compatible with an extra energy from an energetic transformation of Lorentz belonging to the relativistic Big Bang. After the recombination a relativistic *bang* brought a colossal energy surpassing the positive energy already existing. This is an electromagnetic radiation with electrically-charged particles. Gravity tightens the magnetic field lines when it joins the existing gas. Then, the new charged particles moving at relativistic velocities across these lines are, at the same time, slowed down by the collision with the initial particles and accelerated by magnetic lines, producing synchrotron emission.

Notice that the global expansion soon after the Big Bang was at the speed of light and decreases very slowly at first. The term *bang* means a burst of kinetic energy due to a sudden deceleration of the expansion under *c*, obeying the Lorentz transformation. The liberation of energy from a relativistic bang becomes a logical and plausible candidate for the microwave radio-noise source.

3. REIONIZATION

We suggest that ultraviolet light and magnetic fields associated with this source triggered not only the formation of first stars, but attacked also the primordial gases with low density around them, so beginning the change of the physical state of the universes, from a neutral state toward an ionized state.

After the Big Bang, gas was hot and ionized. The universe cooled as it expanded, and the electrons get captured by the ions making hydrogen and helium neutral atoms at the moment of recombination. The CMB followed, transparency replaced opacity, photon scatter off free charges that are not bound in atoms [17]. Observations of galaxies today seem to indicate that most of the volume of the intergalactic medium (IGM) consists of ionized material (since there are few absorption lines due to hydrogen atoms). Space now contains vast regions of ionized hydrogen, designated HII. This implies a period of reionization during which some of the material of the universe was broken into hydrogen ions.

The universe went from ionized to neutral and back to ionized. In an ionized universe, charged particles have been liberated from neutral atoms by ionizing radiation. Astronomers hope to figure out where neutral hydrogen has accumulated over time and when it reverted to its ionized form [18]. They thought previously that neutral gas in the intergalactic medium had been reionized when it was heated by radiation from early stars, galaxies and quasars, about 1 billion years after the Big Bang. But in 2001, a group of astronomers led by Robert H. Becker of the University of California, detected possible signs of the final stages of cosmic reionization at $z \sim 6$. In the spectrum of one of the most distant quasars known, dating to about 900 Myr after the Big Bang ($z \sim 6.28$), they found a telltale signature of neutral gas: all of the ultraviolet light had been absorbed by hydrogen atoms in the ionizing background along the line of sight to this high-redshift quasar. Slightly closer quasars ($z \sim 5$) do not show such complete absorption. These findings suggest the last patches of neutral hydrogen gas were ionized around that time [19].

There has been a new twist in 2003. Investigators on the Wilkinson Microwave Anisotropy Probe (WMAP) team announced that reionization of the universe's intergalactic gas likely occurred roughly 200 Myr after the Big Bang [17]. They thought that if the IGM was ionized when the universe was still denser, then there would be two main effects. First, reionization at this early phase would erase small scale anisotropies. Second, photons scattered off of free electrons (Thomson scattering) would induce polarization anisotropies on large angular scales which are correlated with temperature perturbation on large angle. Both of these effects, which modify the CMB and bring a secondary anisotropy, have been observed by the WMAP satellite, providing evidence that the universe was ionized at very early times, at a redshift larger than 17. WMAP narrowed down the onset of ionizing radiation between 100-200 Myr ($z \sim 30\text{-}20$) and 400-500 Myr ($z \sim 11\text{-}10$) after the Big Bang, but it could not follow the process over an extended period of time [20].

Measurements of the degree of polarization in the cosmic background by WMAP satellite indicate the universe was reionized much earlier, rather than at 900 Myr as implied by the quasar observations. These findings may show the two ends of the reionization period: one the beginning- sometime around 100 Myr after the Big Bang, and one the end- about 900 Myr. The apparent discrepancy between the WMAP and quasar results remains "a genuine big puzzle, and no one knows the physical mechanism that can explain such an extended reionization history"[18].

Our assumption is that this extended reionization history was initially caused by a sudden huge liberation of energy issued from a relativistic bang after the recombination, giving the necessary extra energy-matter to start equally the condensation of the dense gases and the reionization of weaker gases.

4. THEORY OF RELATION AND RELATIVISTIC EXPANSION

The cosmic radiation detected by Arcade 2 constitutes, in the frame of the theory of Relation, a remnant of a huge release of primeval energy provoked by a relativistic bang at around 100 Myr, coinciding with the formation of the first stars and the reionization of neutral gas. Subsequent softer liberations of energy followed via the Lorentz transformation. We estimate that at this time the proton had a speed ~ 298 100 000 m/s and energy $\sim 10^{10}$ eV, which is about 10 times the proton rest mass. (This evaluation is greater than the current assessment. Theory of Relation appraises that until about 5 years after the big bang the speed of the expansion was very near *c* and a hypothetical proton at Planck time would contain more kinetic energy than the estimated $\sim 10^{25}$ eV based on the Planck mass).

4.1 *At least four CBR*

There could be at least four CBR, or cosmic static, which is energy left over from the primordial universe [21]. The first takes its source in the events connected with the matter and the antimatter which took place from the very first microseconds after Big Bang. At Planck time there was a spontaneous symmetry breaking producing graviton flow or gravitational waves. The theory of the standard Big Bang foresees a second: the existence of a fossil radiation of cosmic neutrinos at about 10^{-4} sec [17]. The third CBR, known as CMB, is the electromagnetic microwave background discovered by Penzias and Wilson in 1964. The microwaves came from a time when the universe was hot, dense plasma - a roiling mix of subatomic particles and light. As the universe expanded and cooled down, matter and radiation decoupled, about 380 000 years after the Big Bang. At that instant, the photons were free to travel unimpeded through space for the rest of cosmic history. Filling every sector of the sky, in every direction, the CMB is a direct link to the Big Bang.

Even if this discovery launched the age of modern cosmology, the study of the early universe is hampered by a lack of direct observations. Astronomers have no observations of the era between quasar astronomy at $z \sim 6$ - a billion years after the Big Bang - and CMB astronomy at $z \sim 1\ 000$ - a few hundred thousand years after the Big Bang. We presume that Arcade 2 cosmic radio noise is a relic of this distant past referred to by cosmologists as the Dark Age [18]. Before we examine the effect of this event on the formation of primordial stars and the reionization, let us see first our conception of the Big Bang throught the theory of Relation.

4.2 *Big Bang as seen by the theory of Relation*

Big Bang theory became the standard model for the history of the universe and it rests on the observation that the universe is expanding. In its early cosmic epoch it was a super-small-compressed-hot soup with thermodynamics symmetry, no entropy, everything was energy, movement at the velocity of light. The energy resulting from the big Crunch of a pre-Big Bang was negative with regard to the positive energy of our Big Bang. This means that the negative matter-energy of the pre-universe is transformed into positive matter-energy of our universe. This transformation was made very quickly, almost instantly, during the early universe. With the cooling and the decreasing of the rate of expansion, the transformation of the negative energy-matter into positive ordinary matter became slower and weaker. And it still continues today.

At Planck time there was a broken symmetry, a *thermodynamic imbalance*, a beginning of entropy, a passage of the speed of some particles under the speed of light, and the creation of *two structures* acting like if there was an *impervious separation* between both. It is also the separation of gravity from a superforce merging the four known forces of nature. It is a quantum gravity separated from the strong-electroweak force. We can say that the 'charge' of the quantum gravity begins to decrease at this length of space contrary to the 'charge' of the classic gravitation which begins to increase.

We have seen that our Universe is made of two complementary and interpenetrated structures, the condensation and the expansion [22]. Since the Big Bang, the EM structure of expansion is decreasing, giving up its energy to the positive gravitational increasing structure of condensation, so obeying the principle of Compensation. A perpetual annihilation of the negative energy-mass is transformed into a continual creation of positive energy-mass, through the mechanism of Dirac-Higgs. The first structure of condensation represents the positive solution of Dirac's equation of energy while the structure of expansion expresses its negative energy solution. The structure of expansion being relativistic, we can say that the Big Bang is relativistic. The basic idea is that the initial hot, dense, compact universe started to expand with a huge energy-matter with the constancy of the velocity of light ($v = c$)

$$1 - c^2 / c^2 = 0 \qquad (1).$$

At Planck time the expansion underwent a broken symmetry, the cooling down would have provoked a violent phase of thermodynamics imbalance. The velocity of the negative matter becomes smaller than c

$$1 - v^2 / c^2 \neq 0 \qquad (2),$$

what would have provoked a kind of friction, like a satellite entering in the atmosphere, which would have been capable for warming the universe by creating a huge quantity of fermions and bosons. With this thermal imbalance of the nature, it is "energy which is transformed into matter" (we would rather say "negative energy which is transformed into positive matter"), and not the opposite. It is the "Lorentz transformation of energy ". History of our universe is essentially a constant conversion of energy into matter.

This negative matter-energy, in the theory of the Relation, is usually called 'dark energy'. In its *general* sense, it is a negative EM energy containing bosons and fermions which will be converted into positive matter-energy. Negative bosons will lose some energy (not speed) at the rate of the growing space-time. This tired light, in a *restricted* sense, can be assimilated to the energy of expansion, to the cosmological constant, to the electromagnetic negative wave of space-time, or to the dark energy. The photons of negative energy are converted into photons of positive energy, by reason of the principle of Compensation, becoming photons with mass in the gravific space-time of Einstein [23]. It also generates the hot dark matter which is a form of massive light with particles like the massive neutrino or the hypothetical axion.

4.3 *Relativistic proton*
The speed of expansion of the "negative fermions" converges from *c* toward null speed. When they are converted into positive fermions they acquire inertia, i.e. resistance movement or mass. We can say that they are the ordinary matter, mainly of protons, of the present riemanian-einsteinian spacetime.

In the universe forming, we imagine some relativistic protons (constituted by quarks) with a mass "content of positive energy" enormously bigger than the current rest mass proton. Before becoming a positive matter, it was a particle full of negative kinetic energy stored in a mass "content of negative energy". Speed and energy are connected [24]. The speed *v* of the "energetic" Lorentz transformation implicates both the speed of the matter (galaxies) and the energy of particles which commands the possibility and the nature of the reactions. The growth of space-time and the cooling had the effect of causing them to lose energy, as if their relativistic mass were eroding faster in every small deceleration. The relativistic proton had to lose its surplus of negative energy at the rate of the diminution of the speed of expansion of the universe. Thus, the primeval proton with *v* close to the speed of light, is a proton of ultra high negative kinetic energy

$$M_{OP} \,/\, (1- v^2/c^2)^{1/2} = M_{VP} = M_{OP} + \Delta M_P \qquad (3)$$

(M_{op}: *rest mass of the proton*; M_{vp}: *relativistic mass of the proton*; ΔM_p: *kinetic energy of the proton*; *v is the speed of the particle*).

Energy lost ($v < c$) is got back in the form of proton of ultra high positive kinetic energy. This last one has a cumulative mass and forms the galaxies. The negative protons (and their antiprotons of negative energy) are a part of the dark energy, or negative energy, intended to be transformed into positive energy via the Dirac-Higgs mechanism and the mass-energy equivalence. The relativistic big bang does not need the hypothesis of an unknown cold dark matter during the early universe.

The positive ultra high energetic relativistic protons issued from the event detected by Arcade 2 would have contributed to shape galaxies and reionize very soon the primordial gas. They also constitute the present intergalactic gas and bring most of the ultra-high- energy cosmic particles raining on Earth from every part of the sky. They are a cold ordinary matter because they are relatively heavy, relativistic and electromagnetic.

4.4 *Effects of the Lorentz transformation of energy*
In the early Universe, the variation of the mass-energy, according to small decreases of the high speed, entailed colossal liberation of energy. There was a disproportionate inflationary liberation of negative energy, soon transformed into positive energy, for a tiny slow down of the expansion. After the recombination, because there were no large luminous objects to disturb the primordial soup, the radiation must have remained smooth and featureless for millions of years afterward. As the cosmos expanded, the background radiation redshifted to longer wavelengths and the universe grew increasingly cold and dark [16]. We imagine that the huge energy revealed by Arcade 2 is an energetic Lorentz transformation during the period following the emission of the CMB, which has two effects.

Firstly, it gave the first star-forming system from the dense gases. The transformation of the negative energy into positive energy via the energetic transformation of Lorentz causes a deep *deflation* of the negative energy and an equivalent *inflation* in positive energy. While deflation means that, globally, the radiation of the negative EM spacetime wave redshifted to lower frequencies and the cosmos grew increasingly cold and dark, inflation means that at the same time the lost radiation turns into ordinary positive matter. This new energy joins the smooth and featureless matter, forms the primordial gas clouds at the nodes of a small-scale filamentary network and begins to contract locally because of this extra gravity. Compression heats the gas to temperatures above 1 000 K. Some hydrogen atoms pairs up in the dense, hot gas, creating trace amounts of molecular hydrogen. The hydrogen molecules then start to cool the densest parts of the gas by emitting infrared radiation after they collided with hydrogen atoms. The temperature in these regions drops to 200 or 300 K, reduces the gas pressure, allowing them to contract into gravitationally bound clumps. This cooling plays an essential role in allowing the dense ordinary matter in the primordial system to separate from less dense ordinary matter and also from these strange dark matter particles that emit no radiation or lose no energy. The cooling hydrogen settles into a flattened rotating configuration that was clumpy and filamentary and possibly shaped like a disk. The star-forming system comes to resemble a miniature galaxy, with a disk of ordinary matter and a halo of dark matter. Inside the disk, the densest clumps of the primordial gas continue to contract, and eventually some of them would undergo a runaway collapse and become stars. Earliest stars were massive stars that would have burnt through their fuel within a few ten of millions of years and exploded as either a type 11 supernova or a pair instability supernova. The shockwave from these supernovae would have created a gaseous wind that evacuated the gas out of the neighbouring halo [25, 26]. Supernova massive explosion quashes all nearby star formation, but the expanded gas kick started remote star formation. The basic building blocks of stars were mainly halos of ordinary matter rather than halos of dark matter.

Note: As mentioned above, the halo of dark matter was less gravitational in the early time. The best candidate seems to be the massive neutrino which does not interact with electromagnetic and strong interactions. These neutrinos became cumulative with time and seem to correspond to Weakly Interacting Massive particles (WIMPs), without charge and magnetic fields, making the observed dark matter filaments on the scale of clusters of galaxies between empty voids. We foresee the existence of a particle-- dubbed *tiaxion*-- issued from the cosmologic tired-light and which has some characteristics of the hypothetical axions. They would have been produced by primordial photons robbed of their kinetic energy during the decelerated expansion. The tiaxions thus generated during the big bang were abundant with a huge kinetic energy and had a null mass in the primordial plasma. They continued to be produced during the expansion, acquired mass with lower temperature and became more and more massive. Beside these hot dark matters, an additional assumption would be an intermediate state between negative and positive energies, making up the cold baryonic dark matter. Machos (black holes, neutron stars, white dwarfs, non-luminous objects) could constitute this cold dark matter. This noted, the only sure thing presently about dark matter is that we really know nothing about it.

Secondly, the energetic transformation of Lorentz began the reionization of loosely bound gases, simultaneously with the contraction of dense gases. The relativistic bang concerns emission of baryon accompanied with a strong radiation of bosons. The energetic photons act on the neutral gas which is not dense enough to undergo a compression. They scatter off free charges such as electrons from the neutral hydrogen and helium atoms. Such liberated charged particles by ultraviolet radiation are today at a sufficiently low density in most of the volume of the Universe. The baryons, as the protons, permeate extragalactic gas and are regarded as a major source of ultra-high-energy cosmic rays.

5. CONCLUSION

Some galaxies and quasars shining brightly have been observed a billion years after the Big Bang, so the first stars must have formed sometime earlier. Computer simulations will show then that the first stars to form were massive - between 30 and 300 solar masses, with hydrogen and helium nuclei. These first-generation of huge stars had extremely high temperatures emitting primarily ultraviolet light, burned bright, lived fast, and died young - after just a ~3-million-year life cycle. Astronomers notice, on the basis of the inhomogeneities observed in the fossil radiation, that between the recombination (~3 000 K) in an expansion almost at the speed of light and today (3 K), a quantity of matter misses to allow the effect of gravitation to sow stars. To speed up a process of acceleration, they imagined that dark matter, which acts gravitationally on the galaxies today, would have been present from the beginning of the universe, so supplying the necessary missing matter for a fast contraction of gases without disrupting the isothermal process. Contrary to this current assumption, we think that mass of these gravitational dark matter halos was small in the early time and accumulated gradually with time. And that, if we replace this hypothetical cold dark matter from the beginning by a large amounts of extra energy pumped from a relativistic bang at the dawn of the dark age, ~ 100 Myr, this would have generated and condensed massive clouds in the cores of loosely bound gas and dark matter halos, and thus formed mass clusters of metal-free stars. Contemporaneously with the birth of stars, the reionization would also have started with this surplus of energetic radiation that would have beat and ionize the neutral hydrogen atoms in the vicinity of the dense clouds of gases, carving out a growing bubble of ionized gas around each one. It was without any need for heavy stars, the currently assumed cause. Later was added the reionization of the neutral gases by the radiations of the first supernovae, black holes and the rapid disappearance of the first massive stars.

In sharp contradiction with present cosmological understanding, we postulate the existence of a dark energy issued from a relativistic Big Bang, under the aspect of an expansive electromagnetic wave which quickly transforms its negative energy into positive matter. The residual excess emission detected by the radio antenna Arcade 2 would be another cosmic static from the hot primordial universe. This left over energy would be consistent with a huge release of energy emanating from a relativistic *bang* after the recombination, through an energetic transformation of Lorentz, which would have launched the formation of local high densities allowing gases to contract, to fabricate the first stars and to ionize the neutral less dense gases. So, if Arcade 2 researchers found a real and truly signal through extragalactic radio emissions, it means the discovery of a secondary background radiation which can be explained within the conceptual framework of the theory of the Relation.

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