Expansion of the Universe and Cosmological Redshift

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Abstract

Astronomical observations show generally a redshift of electromagnetic radiation emitted by stars and galaxies that proves they move away from the observer. There are nevertheless numerous exceptions that prove the existence of a blueshift of radiation and consequently an approach of stars and galaxies. This fact together with a few important anisotropies that are present in the spectrum of the Cosmic Microwaves Background Radiation (CMBR) pose important problems for theories of the Big Bang and of the isotropic expansion of the Universe.

1. Introduction

In Einstein's cosmological theory, derived by the General Relativity, the universe is supposed static and to that end he introduced the "cosmological constant" in order to have constant distances among galaxies. Afterwards Einstein wrote that constant was the greatest mistake of his life of scientist. The hypothesis of a static universe was contradicted by the measurement of the cosmological shifts of frequency (largely redshift but also blueshift) that weren't predicted in General Relativity where only a static gravitational redshift was predicted, due to the slowdown of clocks near to great stellar masses. The cosmological redshift instead would prove the existence of a reciprocal departure among galaxies and consequently the existence of a dynamic universe.
The cosmological redshift represents a physical event that isn't well defined yet: in fact the redshift consists in the shift toward low frequencies of electromagnetic frequencies emitted by a source (normally the shift happens into the red band, but at times also into bands with smaller frequencies). It needs also to say in addition to the redshift measurements prove sometimes the existence of a blueshift that consists in a shift toward high frequencies. These shifts can be due in TR to the two different causes[1]:

a. Doppler effect that generates whether redshift or blueshift
b. Atomic cosmological redshift that is predicted in the Theory of Reference Frames (TR)

Stars and galaxies in reciprocal departure generate kinetic redshift like stars and galaxies in reciprocal approach generate kinetic blueshift and it is due the Doppler effect[2][3].
The atomic cosmological redshift instead is an effect that is predicted in the order of the

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Theory of Reference Frames and of Physics of Gravitational Fields[4] and it has a different physical nature with respect to preceding shifts. The atomic cosmological redshift[1] is explained by a different value of electrodynamic mass of elementary particles over different stars and it causes a change of the Rydberg constant[1][4].
In TR besides it is proved the gravitational field doesn't generate frequency shifts[1], but it generates only a small variation of the physical speed of light.
In the most recent cosmological theories a different aspect of the redshift would regard the expansion of the universe. In fact according to these theories if the universe is in expansion, in concordance with GR, also spacetime is in expansion and it would produce a dilation of wavelengths and a simultaneous contraction of frequencies with a consequent redshift.
Let us ask if this effect of expansive cosmological redshift has a meaning also in the Theory of Reference Frames and to that end it needs to consider a few aspects of the theory of the expansion of the Universe.

2. The Big Bang

The most recent considerations on the Theory of the Big Bang claim this theory regards in actuality only the expansion and the cooling of the Universe from a hotest and dense initial stage to a present stage that is still of expansion and cooling with respect to the initial stage but with smaller gradient.
This theory therefore wouldn't regard and wouldn't describe what it happened at the initial instant in which this process of expansion and cooling would be initiated. In a few descriptions of the theory it would be due to a big explosion (big bang) happened according to recent calculations 14 billions of years ago (Peebles, 2001)[5] .
The big bang reminds another history: the Higgs boson that has been called "God particle", i.e. the mather of all particles that would have generated all other particles and would have begun the history of the Universe: through these evident paradoxes the postmodern physics trusts more and more to mythological stories[6].
The Theory of the Big Bang therefore would be unable and it not would have the aim to describe the origin of the Universe but according to the most recent interpretations it would describe only the evolution of the Universe after its birth, because in the origin point the theory has incurable singularities. Consequently the theory isn't able to explain what happened at the zero instant and what the universe was before that instant, besides it is unable to identify the point of the Universe in which the process of expansion started. Anyway in a physical process based on the theory of the big bang that point would have to exist. This consideration involves also that indeterminate point would represent the physical centre of the universe for which all matter would move away from that point in all directions (fig.1).

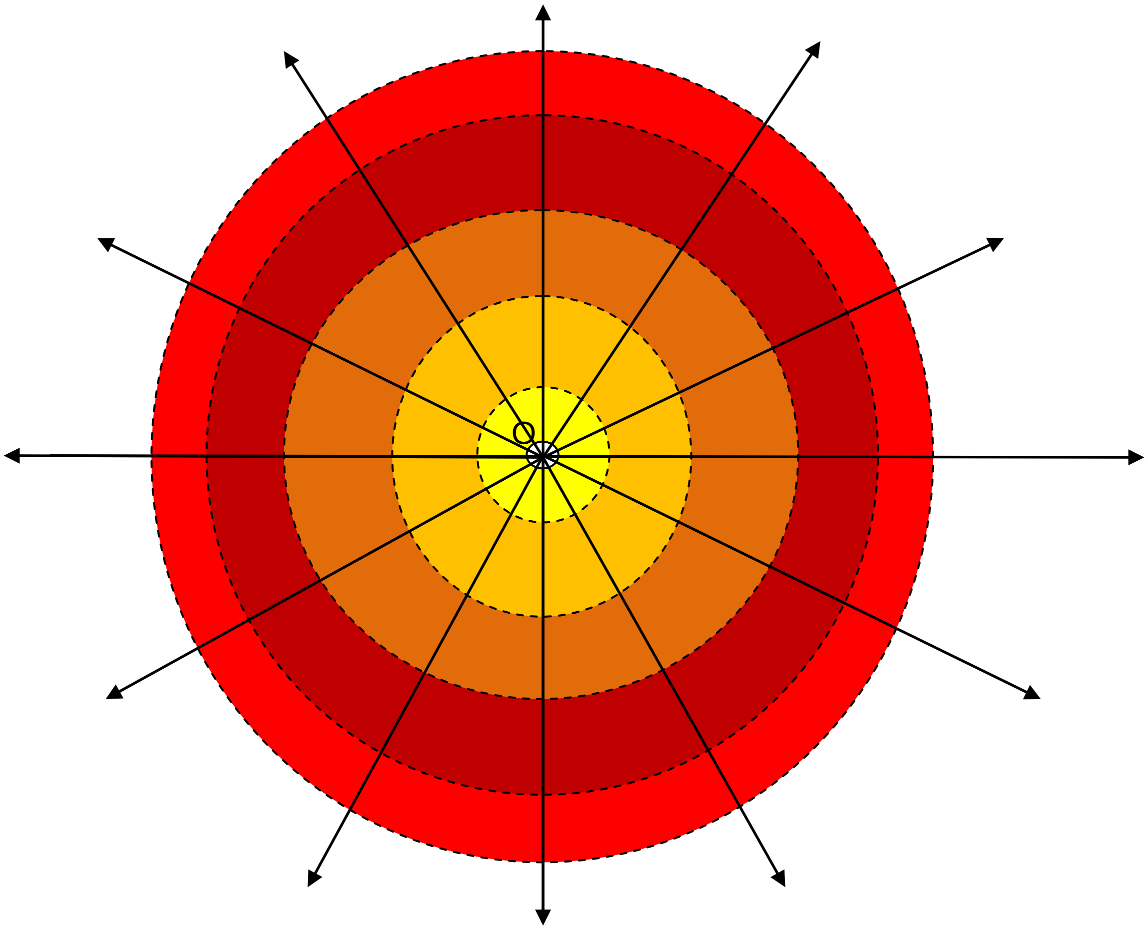

Fig.1 Graphic representation of the big bang and of subsequent stages of expansion and cooling of the universe. The point O represents the theoretical point of the space where the big bang would be happened.

3. Expansion of the Universe

The theory of the Expansion of the Universe is based on the Cosmological Principle, that claims

" The Universe expands similarly with the same speed, in every point of space (property of homogeneity) and in every direction of space (property of isotropy)."

As per the Cosmological Principle, starting from an indeterminate initial instant and from an indeterminate point where the event of big bang would be happened, the Universe began the process of expansion characterized by subsequent initial stages at different highest temperatures and at different speeds in time but anyway equal in every point of space.
Among these initial stages an inflation stage is supposed in which the Universe would be expanded at a greater speed than the speed of light: it nevertheless contradicts the fundamental theory of modern and postmodern physics, i.e. the Special Relativity, in which the speed of light cannot be exceeded unless one accepts that theory presents

exceptions. It nevertheless would contradict one of fundamentals of experimental physics for which also only one fact or experiment that doesn't fulfil the theory produces incurable doubts on the same theory.
In the 1927 Lemaitre formulated a physical law, in evident contradiction with the property of homogeneity of the cosmological principle, for which in the order of the expansion of the Universe, the speed v of a galaxy is directly proportional to the distance D of the galaxy. It is manifest that the distance D is in actuality indeterminate because the point of space in which the process of bing band would be happened is in reality unknown. It involves that generally the distance D is calculated with respect to the observer, who is on the Earth, i.e.

$$v = H_o D \qquad (1)$$

in which H_o is a constant, called later "Hubble constant". The (1) would prove instead the Universe doesn't expand similarly, i.e. with the same speed, in every point of space and it is in conflict with the cosmological principle.
Let us observe the Lemaitre law postulates the speed of any galaxy depends linearly on the distance of the galaxy with respect to a generic observer and just this fact defines the weakness of the Lemaitre law. In fact if the law considers distances of galaxies with respect to an observer, he has to be necessarily the observer of the Earth. Then it is clear that the point of the space, where the big bang is happened, is in actuality defined and it coincides just with the centre of gravity of the Earth. Like this the Earth would be also the origin point of the process of expansion.
This hypothesis is clearly contradictory and absurde and it would position again the Earth in the midst of the Universe and it is in conflict with the Copernican Principle.
Besides even if let us suppose that the origin point of the process of expansion is different from the centre of gravity of the Earth, the point of observation necessarily coincides with one point of the reference frame of the Earth where the obsever is placed. Consequently it is manifest that the point of observation anyway cannot coincide with the theoretical point of the space where the big bang would be happened.
With regard to the figure 2 that describes the Universe in expansion, we can do the following considerations:

1. The point O represents the theoretical point of the space where the big bang would be happened.

2. It is certainly different from the point where the observer of the Earth is placed and this point could be O_T or O_T' or any other point of the space.

3. The Lamaitre law claims the speed of a galaxy is directly proportional to the distance that theoretically would have to be the distance of the galaxy with respect to the effective and unknowable point in which the initial big bang would be happened. In actuality instead the distance is considered with respect to the space position of the observer, that is the only distance that has a physical meaning.

4. The graphic representation shows, for instance, with respect to the hypothetical position O of the initial big bang, the distance of the galaxy 3 is greater than the distance of the galaxy 5. It follows that, as per the Lemaitre law, the speed v_3 of the galaxy 3 is greater than the speed v_5 of the galaxy 5. With respect to the position of the observer O_T' nevertheless the distance of the galaxy 3 is smaller than the distance of the galaxy 5. In that case therefore the Lemaitre law would affirm the speed of the galaxy 3 is smaller than the speed of the galaxy 5.

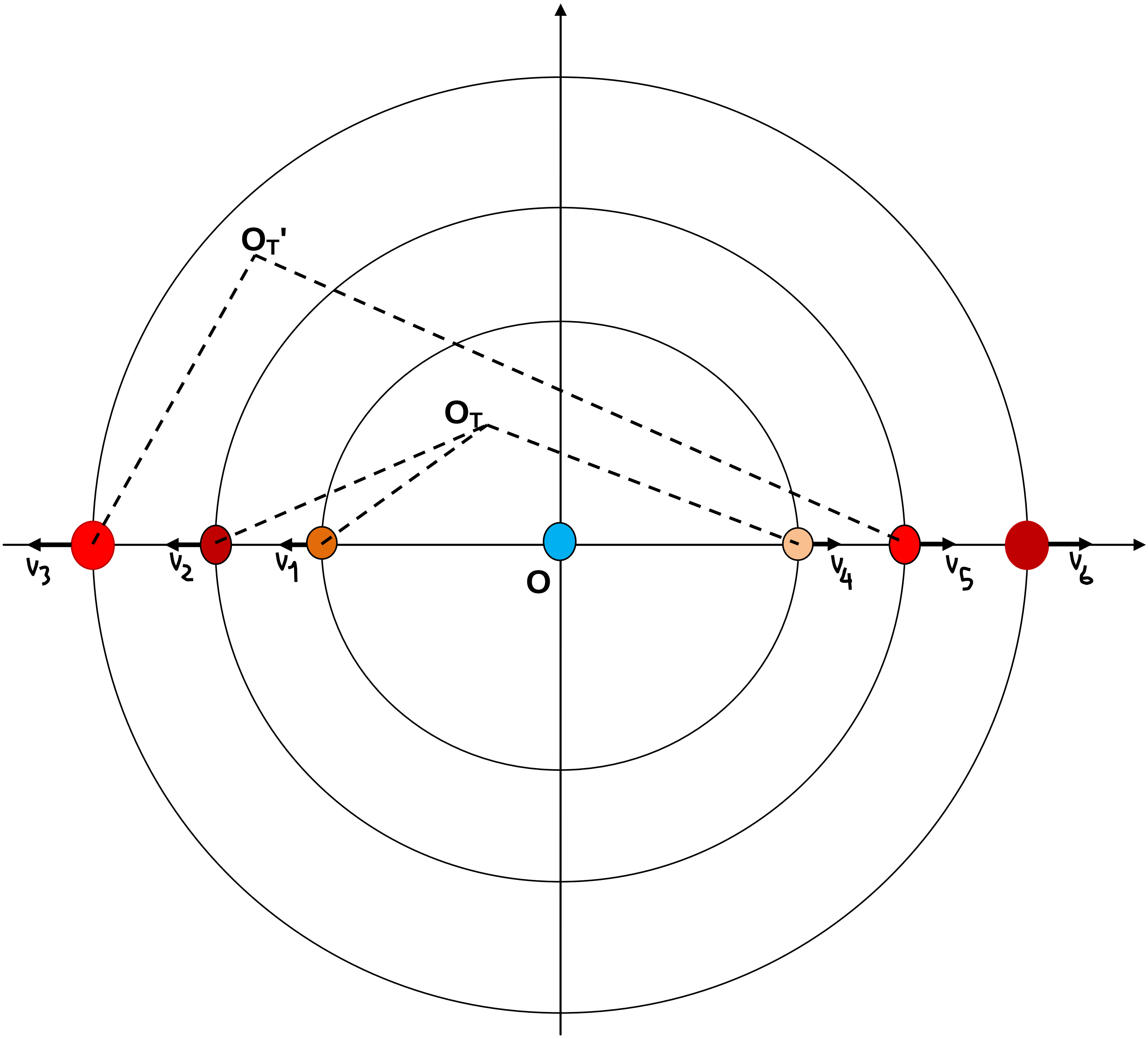

Fig.2 Graphic representation of the expansion of the Universe with respect to the theoretical initial point of the big bang and to different points of observation.

The calculation of distances of galaxies is therefore the critical point of the Lemaitre law. If the measure of distances of galaxies is problematic, it is manifest that also the theoretical calculation of speeds of galaxies as per the Lemaitre law is untrustworthy. It follows that the whole theory of the expansion of the universe and of the big bang presents numerous critical points that prove it isn't an effective scientific theory, also from the theoretical viewpoint besides from the experimental viewpoint, but it is only a hypothesis on the origin and on the evolution of the Universe.

4. Cosmic Microwaves Background Radiation

In the present cosmology the CMBR (Cosmic Microwaves Background Radiation) is the "residual electromagnetic radiation generated by the Big Bang". It is a weak radiation into the microwave band, approximately isotropic with small anomalous anisotropies.
CMBR has the spectrum of black body at a temperature of 2.75K and this spectrum presents a peak in the microwave band at the frequency of 160.2GHz (fig.3).

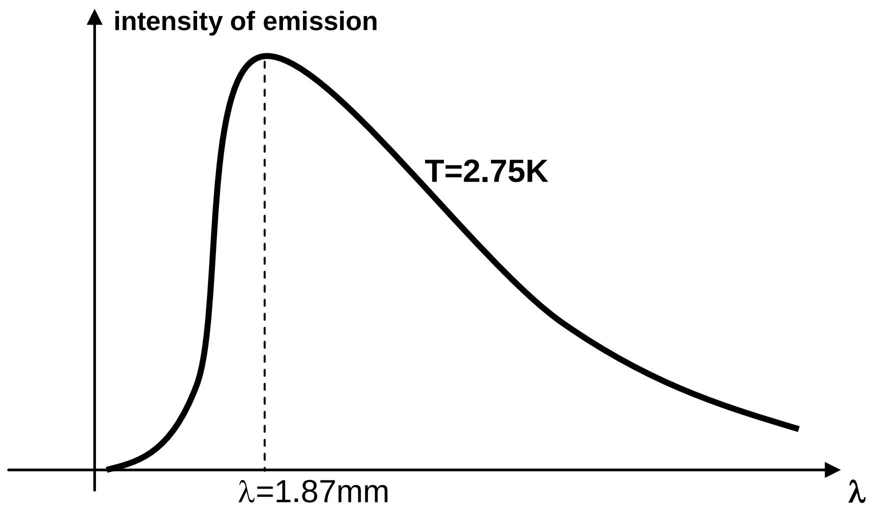

Fig. 3 Emission spectrum of black body for explaining the CMBR

The CMBR is almost uniform in all directions with the presence of small anisotropies. The inflation theory of the Big Bang predicts after about 10^{-37}s from the initial explosion the expansion of the Universe had an exponential increase and after 10^{-6}s the primordial universe was made up of a warmest plasma composed of photons, electrons and baryons. The further expansion of the universe caused the cooling of the plasma that made possible the combination of electrons and protons and the formation of hydrogen stable atoms. From data of the CMBR it derives our galaxy, including the Milk Way and Sun System, would move with a speed of about 627 Km/s with respect to the hypothetical coordinates of reference of the CMBR that in that case would assume characteristics of a resting reference frame. This motion would produce an anisotropy of data because the radiation CMB seems to have a bit greater frequencies towards the motion of the galaxy than into reverse. These changes of frequency are due to the relative motion of the observer with

respect to the CMBR, and consequently the observer measures a redshift in the event of departure and a blueshift in the event of approach.
These experimental data therefore invalidate the cosmological principle that predicts instead isotropy and besides the fact that the observation of the CMBR doesn't happen in the order of a symmetrical position of the observer with respect to the point of the Big Bang, raises serious problems. Besides because the CMBR is a "residual electromagnetic radiation generated by the Big Bang", necessarily it has transitory nature because the Big Bang has transitory nature and consequently it is measurable only in a transitory period of time. The radiation CMB anyway represents no way a reference frame and still less an absolute reference frame that would represent a kind of postmodern ether.
Instead of the residual radiation of the Big Bang, as per to an alternative interpretation for the CMBR in the order of the Theory of Reference Frames (TR), the CMBR could be due to the effect of black body of the empty intergalactic space. In that case the empty intergalactic space is a medium that besides known physical properties of permittivity, magnetic permeability and mechanical resistance, would have also physical properties of black body: i.e. it absorbs all electromagnetic energy that goes into the intergalactic space without reflection. Later it emits a radiation into the microwave band, that is typical of black bodies and is near to the infrared band. In that case numerous zones of intergalactic physical vacuum would behave like immense cavities.

5. Expansive cosmological redshift in TR

Two years after the formulation of the Lemaitre law, Hubble formulated (1929) the Hubble law, that describes a linear relation between the redshift od light emitted from galaxies and distances. The redshift is defined in cosmology by the parameter z

$$z = \frac{f_e - f_o}{f_o} \qquad (2)$$

where f_e is the frequency emitted from the galaxy and f_o is the frequency measured by the observer that is generally on the Earth. Considering in the Theory of Reference Frames the frequency measured for the longitudinal redshift is given by[2][3]

$$f_o = f_e \left(1 - \frac{v}{c}\right) \qquad (3)$$

from the (2) we have

$$z = \frac{v}{c} \qquad (4)$$

in which c is the physical speed of light.
From the Lamaitre law (1) we obtain the Hubble law

$$z = \frac{H_0 D}{c} \quad (5)$$

The important fact is that in the Theory of Reference Frames the Hubble law is valid for all values of the speed v while in Special Relativity the (5) is valid only for v<<c and therefore for small values of z. This is certainly a further weighty theoretical limitation of Special Relativity. Anyway in TR

- For z>0 there is a real effect of cosmological redshift due to the Doppler effect because of the departure of galaxy with respect to the point of observation that necessarily is placed in a reference frame of the Earth.
- For z=0 the observed frequency coincides with the emitted frequency and the relative speed of galaxy with respect to the observer is zero.
- For z=1 the relative speed of galaxy with respect to the observer is equal to the physical speed of light.
- For z>1 the speed of galaxy in departure is greater than the speed of light: effective values of z>1 have been measured in the order of the observation of particular galaxies (pulsar, quasar).
- For z<0 the observed frequency is greater than the emitted frequency and consequently the outcome is a real effect of blueshift [1][2][3][7].

Besides the atomic cosmological redshift, in TR the expansive cosmological redshift substantially is due to the Doppler effect of departure of single galaxies from the observer while galaxies in approach generate an effect of blueshift. In TR a general expansion of spacetime and of the Universe doesn't exist but the observed effects of redshift and of blueshift regard the single behaviour of galaxies and of stars and not the global unified behaviour of all galaxies. Distances D are in that case distances of galaxies and of stars with respect to the observer of the Earth.
For instance the star Arturo shows a redshift while Vega shows a blueshift.
The CMBR and the cosmological redshift are considered fundamental proofs in support of the Big Bang model but conclusions of this paper bring into question the validity of that model and of the unified expansion of the Universe.

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