12.B.12 Lyman Alpha Forest

It was shown in §12.B.4.2.3 that the observed large cosmological Z-shift (in a stationary Universe) is a result of accumulated red shifts obtained from the consecutive passing of the photon (or any type of quantum wave) through a large number of GSSs. It will be very useful if we are able to identify signatures from these multiple red shifts. Such opportunity, fortunately, is provided by the distant quasars. Now BSM is able to provide a correct interpretation of the phenomenon know as a **Lyman alpha forest**. The explanation of this phenomenon is a following:

The Lyman alpha forest is related with the quasar observations. The quasar phenomenon was explained in §12.B.11. The Hydrogen as one of the most abundant and light element, in the galaxies flows through the pipe of the quasar, driven by the ZPE potential difference between the CL spaces, which are connected by the pipe. The strongest line of the excited atomic Hydrogen is L_α (Lyman alpha) at 121.6 nm. The line emitted from the flowing Hydrogen in the pipe is significantly Doppler broaden, due to the helical motion, illustrated in Fig. 12.48. (lines from other elements are also Doppler broaden). The emitted photons after passing through the first GSS (between the pipe and host galaxy) appear red shifted in the host galaxy. Then the normal absorption of the narrower L_α line appears superimposed on the spectral profile of the broaden and red shifted line from the quasar. This feature is red shifted constructively when the photons pass through the GSS of the closer to us galaxies. Additionally in every consecutive galaxy the signature of the absorbed L_α is superimposed. The broaden quasar line appears red shifted in every consecutive GSS, serving as an illuminating source for narrower absorption L_α line in the galaxy through which it passes. The absorption lines does not have the broadening mechanism of the quasar emission line. So they are distinguishable. The degree of their separation depends only of the degree of difference between the prisms of neighbouring galaxies (different diameter/length ratio of the prisms, see §12.B.4). Fig. 12.51 illustrates the formation of L_α forest in the detection side.

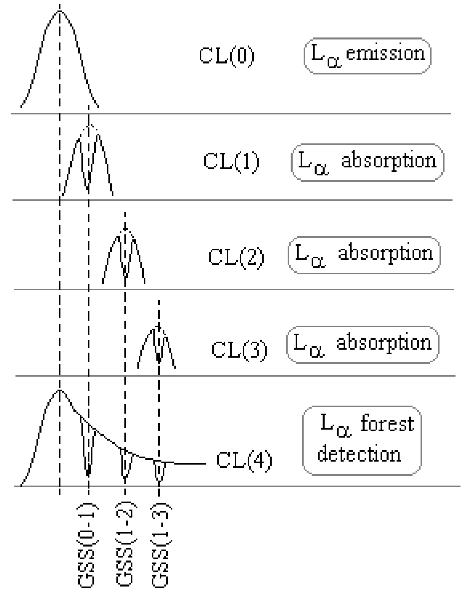


Fig. 12.51 Formation of L_α forest from a distant quasar

The following notations are used:

CL(0) - space of quasar pipe

CL(1) - space of the host galaxy of the quasar

CL(2), CL(3) consecutive galaxy spaces

CL(4) galaxy of detection

GSS(0-1) - galaxy separation surface between CL(0) and CL(1).

The following features are apparent for a distant quasar, where the possible Doppler shift component is negligible in comparison to the total cosmological Z-shift

(a) the number of absorption components are equal to the number of intercepted CL spaces, but the quasar pipe CL space is not included

(b) the redshift from a single GSS is approximately proportional to the difference between diameter/length ratio of the prisms for the neighbouring galaxies

(c) the envelope of the detection signal is affected by: the number of crossed GSSs, the attenuation from dust in every galaxy and the absorptions in every passed galaxy.

(d) if neglecting the attenuation from the dust, the amplitude of any absorption component is determined by the absorption through the current galaxy CL space.

(e) the first absorption component is from the host galaxy, where the quasar pipe is located.

Fig. 12.51.A illustrates Lyman alpha forest observations reported by A. Songalla, E. M. Hu & L.L. Cowie (1995).

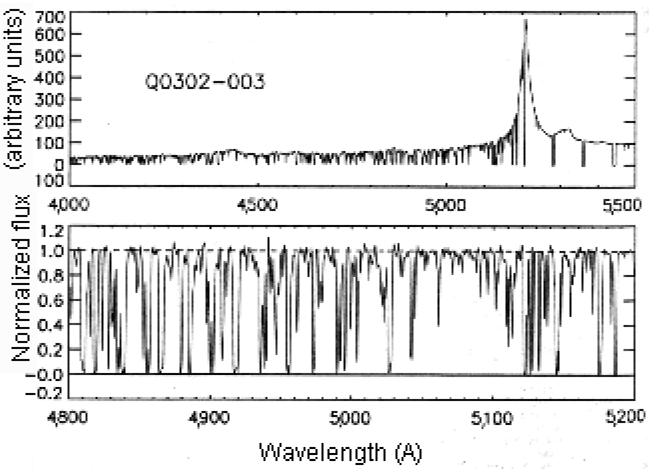


Fig. 12.51.A. Top, high resolution spectrum of the quasar QO302-003 (emission redshift Zem = 3.286), which is the sum of eight 2,400-s exposures made with the HIRES spectrograph at the Mauna Kea, Hawaii on the nights of 1994 September 16 and October 14 UT. Courtesy of A. Songalla et al..

12.B.13 Estimation of cosmological distances

12.B.13.1 General considerations

Number of methods are used so far for measuring of cosmological distances, but according to the concept of Big Bang the distance could be considered only as a momentary distance at fixed moment. For this reason the distance has been often referenced as a "distance of expanding Universe". This is a result of not correct interpretation of the cosmological red shift, assuming that it is of Doppler type.

In the BSM concept of a Stationary Universe the distance is a stable real parameter in a classical sense. The cosmological component of the Z-shift was discussed theoretically in §12.B.4.2. It was shown how this component obtains significant increase for large cosmological distances. If the z-shift is assumed as a Doppler shift it provides completely wrong picture of the Universe. BSM clearly shows, that the Universe is a stationary with galaxies undergoing a quasiperiodical recycling process. Fortunately, the Z-shift parameter still could be used for aproximative estimation of large cosmological distances. A proper interpretation and correction only is necessary.

In §12.B.4.2.3 and Fig. 12.23 the consecutive red shifts from GSS has been presented. The energy loss of a photon crossing GSS was discussed in §12.B.4.2.2 and the effect of the accumulated energy in the GSS was explained in §12.B4.2.3 by the observed diffused X-ray radiation. The signature of the cosmological redshift is apparent from many observational effects:

(a) from the analysis of cepheids of II population

(b) from the motion analysis of stars in the globular clusters

(c) from the large red shift in the filament structures of the Crab nebular

(d) from the large red shift in the filament structures in the galactic Centre

(e) from the Z-shift periodicity

(f) from the interpretation of the forest Lyman alpha

The large red shifts for cases a, b, c, d are results of emissions from remnants of previous galaxy life (in respect to the host galaxy).

12.B.13.2 Lyman alpha forest method

This is the simplest aproximative method for estimation of large cosmological distance. For a distant quasar (with a large z-shift) we have a large number of absorption L_α lines. In such conditions we may accept that the average intergalactic distance is equal to the average length of the galaxy CL space. We may call this parameter a **mean size of galaxy space**. Then the number of absorption lines should correspond to the number of GSS minus one in the line of sight. So if we know the mean intergalactic distance, $\tilde{L}$ (equal to a mean size of galaxy space) we can determine the approximate distance (r) to the quasar simply by the product:

$$r = (N-1)\tilde{L} \text{ - for quasar} \qquad (12.46)$$

$$r = N\tilde{L} \text{ - for emitting objects of I-st population} \qquad (12.47)$$

where: - $\tilde{L}$ is a mean intergalactic distance, N - is a total number of the absorbed L_α lines in the forest for a range of $0 < Z < Z_Q$, Z_Q is the quasar Z-shift

The relations (12.46) and (12.47) are approximative because the the galaxy sizes varies more than one order, but the accuracy is improved for a large statistics, i. e. if we estimate data from objects with a large z-shift.

The total number (N) of absorbed L_α lines can be determined from the equation of the cosmological Z-shift (see §12.B.4.2.4):

$$(\bar{n})^N = z + 1 \qquad [(12.48)]$$

Solving for N we get:

$$N = \frac{\ln(z+1)}{\ln(\tilde{n})} \qquad (12.49)$$

where: $\tilde{n}$ is a **mean GSS quasirefractive index (**defined in §12.B.4.2.4 by Eq. (12.27) for N >> 1).

Substituting N given by Eq. (12.49) in Eq. (12.47) we obtain **the equation of the cosmological distance in function of Z-shift.**

$$r = \tilde{L}\frac{\ln(z+1)}{\ln(\tilde{n})} \qquad (12.50)$$

Layman alpha forest observations usually does not cover the whole spectral range of redshifted absorption lines. The more easier directly observed parameter is the number density of absorbed L_α lines. The theoretical value of this parameter is obtained by differentiating the Eq. (12.49) on *Z*.

$$\frac{dN}{dZ} = \frac{1}{(Z+1)\ln(\tilde{n})} \qquad (12.51)$$

The estimation of the line density, according to BSM, is dependable on the proper selection of the observed L_α set. For this reason different investigators provide different empirical estimation of the number density in function of z-shift. W. L. W. Sergent et al. (1980) found that the line density is pretty independent of z-shift and corresponds approximately to 60 lines per unit redshift at $Z = 2.45$ Murdock et all.(1986) investigating the line density in a number of sets found that the individual density trend in a single set differs from the common trend of the sets. The reason for such difference according to BSM is that the parameters $\tilde{n}$ between neighbouring galaxies are strongly correlated.

The BSM concept shows, that the better method for estimation of line density and the parameter $(\frac{dN}{dz})_o$ is:

- finding the fitting equation from every separate forest set measured by own quasar
- obtaining a common fit equation by assembling the separate fitting equations

The more accurate obtaining of $\tilde{n}$ is dependable also on the spatial position of the line of sight, due to the spatial anisotropy effect and the inhomogeniety of the observable Universe (according to BSM concept) as a transparent medium. If the above considerations are taken into account, more realistic value of $\tilde{n}$ could be obtained by fitting the theoretical expression (12.50) to the data.

The line density vs z-shift has been studied by number of scientists, but the above mentioned considerations has not been evident because the z-shift parameter has been considered so far as a Doppler shift. Then it is not a surprise that different authors obtain quite different empirical dependence of the line density vs z-shift. Eq. (12.50) shows that the standard variation of this parameter for low z-shifts (below 1 and approaching zero) will be much larger, than for a larger z.

For estimation of large cosmological distances, when z-shift is known, (by Eq. (12.50)) the knowledge of mean galaxy length and mean quasirefractive index are both necessary. The latter parameter is directly obtainable from Eq. (12.51), while its physical meaning is discussed in the next paragraph.

12.B.13.3 Theoretical concept of the Universe optical inhomogeniety

12.B.13.3.1 Light propagation from energetic point of view

Energy transfer as EM waves between the matter from different connected galaxies is possible only through CL space. Connected CL spaces of the separate galaxies form the CL space of the Universe through which we get information from the connected galaxies. Therefore the CL space of the observable Universe is a conglomerate of CL spaces of the connected galaxies. The prisms of the individual galaxies contain equal amount of intrinsic matter but they are formed in separate processes under different formation forces (defined by the total mass of the galaxy) , so they may have different diameter/length ratio. Consequently, the space of the visible Universe is inhomogenious. The degree of inhomogeniety depends on the difference of the diameter/length ratio of the prisms in the interconnected galaxies.

The **mean GSS quasirefractive index,** $\tilde{n}$**, (**defined in §12.B.4.2.4 by Eq. (12.27)) could serve as a parameter of the Universe inhomogeniety.

$$\bar{n} \approx \frac{\lambda_1}{\lambda_0} \approx \frac{\lambda_2}{\lambda_1} \approx ....\frac{\lambda_i}{\lambda_{(i-1)}} > 1 \qquad [(12.27)]$$

In the previous paragraph we found that this parameter could be estimated by the absorption line density. Solving Eq. (12.51) for $\tilde{n}$ we obtain

$$\tilde{n} = \exp\left(\frac{1}{(dN/\mathrm{dz})(z+1)}\right) \qquad (12.52)$$

Taking into account the considerations (in the previous paragraph) about the estimation of the line L_α density, we may calculate $\tilde{n}$ only for some limited points of z-shift from carefully selected observational data. W. L. W. Sargent et al, (1980) have investigated L_α forests from six QSOs in the quasar z-range $1.7 < z < 3.3$ and found that the mean line density per $\Delta z = 1$ at $z = 2.45$ is about 60. Then the mean quasirefractive index ($\tilde{n}$) is:

$$\tilde{n} = \exp\left(\frac{1}{60(2.45+1)}\right) = 1.0048 \qquad (12.53)$$

H.S. Murdoch et al. (1986) provide different empirical equation for estimated line density.

$$\frac{dN}{dz} = 4.06(1+z)^{\gamma},$$

where $\gamma = 2.17 \pm 0.36$. Then for their sample at z = 3.5

$dN/\mathrm{dz} = 106$ (lines per $\Delta z = 1$). The corresponding mean quasirefractive index from this data is:

$\tilde{n} = 1.0021$ (by Murdoch et al.,1986) (12.54)

The estimated value for dN/dz varies significantly from the observational samples. It seams to be dependable on the spatial direction as well. Then the parameter $\tilde{n}$ will also exhibit variations.

Comparing the obtained above two values of $\tilde{n}$ with the value of 1.0002 for quasirefractive index of GC M5 (obtained by the spectrum - see §12.B.7.2.2), we see that the latter is much smaller. This is reasonable when considering that the GC is a remnant of the previous life of the home galaxy and the prisms diameter/length ratio should be much closer in this case.

From the above mentioned observational data we may accept that the probable range of the mean GSS quasirefractive index is

$$1.0021 < \tilde{n} < 1.0048 \qquad (12.54.a)$$

12.B.13.3.2. Wavelength dependence of light direction through GSS

The light propagation through GSS is not adequate to the light propagation in the classical optics from media with one value of refractive index to another (for example between air and glass or between two glasses with different refractive indices). In the classical optics the CL space parameters inside the glass are modulated by the solid glass body. The internal wavelength $\lambda_{SPM}*$ is distinguished by the external one. In case of light propagation through GSS:

(a) both CL spaces in the GSS zone are away from any material object, so there is not any CL space modulation of matter

(b) the quantum conditions in both CL spaces are optimal for their parameters

(c) the slight difference in the propagation is caused by the slight difference in the prisms parameters (diameter/length ratio)

From energetic point of view:

(c) a photon propagating in different optical media immersed in a common CL space does not exhibit any energy loss.

(d) a photon propagated through GSS exhibits an energy loss (appeared red-shifted)

Based on the above consideration we may regard the change of the direction of the light through GSS as a result of a wavelength dependence of the refractive index.

Let first considering an ideal case of parallel GSS along the line of sight and ignoring the cosmological red shift. Any photon from a distant galaxy crosses a number of GSS. The deviations of the individual quasirefractive indices from the mean value $\tilde{n}$ are positive and negative. Their weight in the definition of $\tilde{n}$ is balanced. Consequently we could not expect deviation of the direction between the emitted and detected photon in this case.

Now let considering the real case when the emitted photon passes number of GSS under different oblique angles. **Due to its consecutive red shifts at every GSS it will get some deviation in respect to the first ideal case.**

The described effect could be modelled by a set of glass slabs between the light source and detector. The refractive index is selected in a way that the difference of refractive index between any neighbouring slabs is equal to the z-shift at the corresponding GSS. In such way the refractive index decreases from the source to the detector.

One important fact in the real case is that the quasirefractive index is very close to unity. The glass model is distinguished in this aspect, because the lowest glass index is in order of 1.44. In the same time, the variation of the refractive index on the wavelength (defined by the first derivative $dn/d\lambda$) is quite small. The trend of the first derivative for set of different glasses also decreases with the decreasing of the refractive index of the individual glass. This is evident from n_d/v_d diagram of the glasses (see SHOTT catalogue).

Now we may define in a similar way a wavelength dependence of the mean quasirefractive index $\tilde{n}$ from the wavelength.

$$\frac{d\tilde{n}}{d\lambda} = n' \approx \frac{n_{i+1}}{n_i} = \frac{1+\varepsilon}{1-\varepsilon} \qquad (12.55)$$

where: ε is expected to be very small

We may call the parameter n' **a chromatic mean quarirefractive index.**

Note: While the mean GSS quasirefractive index $\tilde{n}$ is not dependable on the wavelength the chromatic mean quarirefractive index n' is dependable, because the red shift for the distant observer accumulates.

Now let suppose that the direction of a photon crossing a single GSS is affected in a similar way as the photon passing through a boundary between two optical media whose indices correspond to n_i and n_{i+1} in Eq. (12.55). The deviation of the photon direction then is given by the classical Snell's law.

$$n_1 \sin\theta_1 = n_2 \sin\theta_2 \qquad (12.56)$$

where: n_1 and n_2 - are refractive indices; θ_1 and θ_2 - are the angles between the normal to the boundary surface and the director of the photon (ray).

Let index 1 in Eq. (12.56) is for the input ray and index 2 for the output ray in the classical optics model. If $n_1 < n_2$ (as air - glass case) then $\theta_1 > \theta_2$. In the same time the photon wavelength, referenced to air is also changed. $\lambda_1 < \lambda_2$. The difference $\Delta\lambda = \lambda_1 - \lambda_2$ should be equal to the red shift from a single GSS.

Combining the Snell's law and the defined by Eq. (12.55) chromatic index we get

$$\sin(\theta_1) = n'\sin(\theta_2) = \frac{1+\varepsilon}{1-\varepsilon}\sin(\theta_2) \qquad (12.57)$$

Relying on the provided analogy we may define the following hypothesis:

Hypothesis: **Photon (quantum wave) propagated through GSS at oblique angle exhibits slight change of incidence angle simultaneously with the energy loss (z-shift).**

The suggested hypothesis does not mean that the image from any galaxy may exhibit a chromatic distortion, because the size of any galaxy is much smaller than the size of its CL space. Having in mind that the average galaxy size is at least 100 times smaller than the average CL size, chromatic distortion may not exist for the single galaxy but slight distortions may exist for sky images of galaxies within a large viewing angle.

Summary:

(1) The light propagated through GSS at oblique angle may slightly change its direction according to some chromatic dependence of the quasirefractive index

(2) Achromatic light forming an image of single galaxy does not exhibit a chromatic aberration from the cosmological redshift effect.

(3) A chromatic aberration effect may exist only for images of galaxies in a larger field of view when the optical rays cross different number of GSSs with different sizes and different quasirefractive indices.

12.B.13.4 Existing methods for determination of cosmological distances independently from the concept of the expanding Universe.

The cited below methods are used for calibration of the Hubble "constant", which according to the BSM concept appears as a constant only in a limited cosmological distance. Different methods cover different ranges that are offset by different distances from the observer. As a result, the large cosmological distances could be estimated only by correct intercalibration between the methods working in different ranges. These approach is often referred as a **cosmic distance ladder**. The ranges that the separate methods cover according this approach are illustrated by Fig. 12.52.

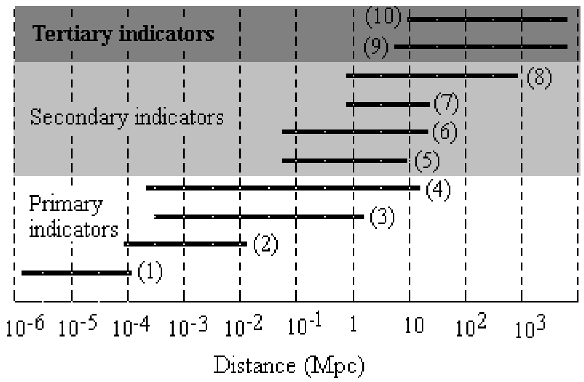


Fig. 12.52.

Methods for estimation of cosmological distances and their positions in the cosmic distance ladder scale

Some of the used so far methods should be reconsidered due to the following phenomena discovered by the BSM theory:

(1) The cosmological origin of the red-shift

(2) Globular Clusters (GC) in distant galaxies looks brighter due to the cosmologically shifted lines from the same types of lines but emitted by the host galaxy matter.

(3) The exciting mechanism of the external layers of the cepheids from the released RL(T) structures (equivalent to a neutral and charge currents according to the electroweak (V-A) theory)

(4) The rotational motion of the galactic matter may not be in a stationary phase

These phenomena will affect the following methods of distance estimation:

- Cluster H-R diagram fitting (affected by the phenomenon (1))
- Cepheids (affected by the phenomenon (3)
- Brightest stars in galaxies (affected by the phenomenon (3))
- Globular clusters (affected by the phenomenon (2)
- Tully-Fisher relation (affected by the phenomenon (4) and a-parameter dependence of the observed wavelength (see L. Bottinelli et al (1983)).
- Supernovae (affected by the phenomenon (3)).

The distances estimated so far according to the Big Bang concept are based on the assumption that the Hubble distance-velocity relation of the Hubble law is a constant (due to the Doppler interpretation of the observed z-shift). The distance-velocity relation is empirically obtained by measuring the distances by the methods show in Fig. 12.52.

12.B.13.5 Experimental results showing one of the major Big Bang paradoxes.

The correct value of the Hubble constant has been and continues to be a debated topic for about a 100 years. Enormous observational material is obtained, but the Hubble "constant" continues to be one enigma. For small z- shift the Hubble law shows a deviation from linearity, but this has been attributed to a statistical error due to small number of observations. However, recent observations for z-shifts up to 0.8 show an additional deviation from linearity in a completely unexpected direction.

The classical plot of the Hubble law is a velocity (km/s/Mpc) vs Distance (Mpc). In the scientific papers the Hubble plot is given more often as an apparent magnitude (of the observed galaxies) vs z-shift. It preserves the "linear" appearance of the classical Hubble plot if both axes are linear or logarithmic. The apparent magnitude has a logarithmic relation to the distance according to the expression

$$m - M = 5\log(d) - 5$$

where: m - is the apparent magnitude, M is the absolute magnitude, d - is the distance.

Figure 12.54 shows a Hubble plot for z-shifts up to 0.8 provided by Perlmutter et al., Astrophys. J. 517: 555-586, 1999; available also in http://laml.arxiv.org: astro-ph/9812133. The data are obtained from a ground based telescopes. The parameter m_B, called an effective magnitude is a restframe magnitude, corresponding to the observed brightness corrected for width luminosity relation. The theoretical curves shown in Fig. 12.54 are characterized by two parameters Ω_m and Ω_Λ, the mean mass and dark-energy densities of the cosmos, normalized so that their sum is precisely one.

The observations lead to the conclusion that

$$\Lambda = (\rho_{vac}/\rho_{cr}) > 1 \qquad (12.64.a)$$

where: ρ_{vac} and ρ_{cr} are respectively the vacuum energy density and a critical vacuum energy density.

The parameter Δ is related to the cosmological constant introduced initially by Einstein in General Relativity. However, later he dropped it from his equations, referring to it as his greatest blunder. The cosmological constant and the Δ parameter, however, are still used in the Big Bang concept, so the obtain result ($(\Lambda > 1)$ means that the Universe should be expanded forever. Such conclusion, however, is contradictable to the logical understanding of the Big Bang. In order to save the Big Bang concept a "vacuum energy of unknown character" has has been introduced.

The enigma of expanding forever Universe is confirmed by observations provided by the Hubble space telescope and published recently by A. G. Riess et al. (2004),Astrophys. J. (in press), also in: (http://arXiv.org/abs/astro-ph/0402512).

Figure 12.56 provided by A. G. Riess et al. (2004) provides a Hubble plot of data for z-shifts up to 1.75 together with some theoretical plots. The data interpretation leads to a conclusion that it has been deceleration in the initial phase of the Big Bang, while at $z = 0.46 \pm 0.13$ a cosmic "jerk" (authors terminology) changes the deceleration to acceleration. Such cosmological behaviour, however, is completely illogical. Attempts are made to explain this cosmic paradox by evolution of the "dark energy". For this reason an equation of state with parameters "ratio of negative pressure to energy density" is used but the explanation is away from the common sense logic.

From a point of view of the BSM, however, the obtained experimental data appear to fit quite well to the the analytical results from the BSM concept about the stationary Universe. The derivation of BSM results are described in the next paragraph.

12.B.13.6 New interpretation of the Hubble law.

12.B.13.6.1 General considerations:

According to the concept of the Big Bang theory the z-shift is of a Doppler type, so the distance of the "expanding" Universe is determined by the simple relation:

$$r = \frac{zc}{H_0} \quad [\mathrm{m}] \qquad (12.64)$$

where: z - is the observed redshift, c - is a light velocity and H_0 is a Hubble constant (velocity/distance).

For a not relativistic velocity ($z < 1$) the product *zc* provides the expanding velocity using the classical Doppler shift formula. For observations with $z > 1$ the classical Doppler shift formula provides velocity larger than the speed of light, but quasars with z-shift up to 4 has been observed. In order to save the concept of the Big Bang a relativistic formula for Doppler shift is used in which case the velocities could not exceed the speed of light in any value of $z > 1$. More distant galaxies shows a larger z-shift, however, numerous exceptions from this rule exist known as a peculiar velocities (or z-shift) for which one could not find any explanation. According to Sten Odenwald and Rick Fienberg, (1993), "the adoption of the special relativistic Doppler formula by many educators has led to a peculiar 'hybrid' cosmology which attempts to describe Big Bang cosmology using general relativity ".

The Big Bang concept of expanding Universe relies also on the assumption that the parameter H_0 is close to a constant. The parameter H_0 is formulated as a velocity-distance relation by the great astronomer Hubble. **Hubble did not like the idea of expanding Universe**, but this interpretation has been adopted by the modern physics because it fits to the developed in that time concept of the expanding Universe (Gamow's Big Bang theory).

12.B.13.6.2 The Hubble constant from the BSM point of view.

A. general considerations

In the Big Bang concept the relation product $((zc)/H_0)$ is regarded as a **momentary distance**, while $H_o = zc/r$ is denoted as a Hubble constant. According to the BSM concept it is not a constant in a perfect sense, but with a first approximation we may consider it as a constant.

B. Derivation of the Hubble law

Using the Hubble law as a relation between the concept of expanding Universe (according to a

Big Bang) and the concept of a stationary Universe (according to BSM), we may conclude that:

A. For an infinite small range of distance (or z-shift), the instant distance according to the concept of expanding Universe should be equal to the real distance according to the concept of the stationary Universe, only

The distance in the expanding Universe is given by Eq. (12.64) while in for a stationary Universe we derived Eq. (12.50). Equating two equations we have.

$$r = \frac{zc}{H_o} = \tilde{L}\frac{\ln(z+1)}{\ln(\tilde{n})}$$, from where:

$$H_o = \frac{zc\ln(\tilde{n})}{\tilde{L}\ln(z+1)} \qquad (12.65)$$

Let: $A = \frac{c\ln(\tilde{n})}{\tilde{L}} = const$ (12.66)

For an infinite small range of distance (differentiating Eq. (12.64)) we have

$$dr = \frac{c}{H_o}dz \qquad (12.67)$$

Multiplying Eq. (12.65) by Eq. (12.67) and dividing the result on H_o we get:

$$dr = \frac{Ac}{H_o^2}\frac{z}{\ln(z+1)}dz \qquad (12.68)$$

Integrating Eq. (12.68) in a range from 0 to z we obtain

$$r = \frac{Ac}{H_o^2}\int_0^z \frac{x}{\ln(x+1)}dx \qquad (12.68)$$

Let $r_n = r(Ac/H^2{}_o)$ is a normalized distance, a dimensionsless parameter, defined by the following constants: c - a light velocity, $\tilde{n}$ - an average quasirefractive index of GSS, $\tilde{L}$ - an average distance between the galaxies, H_o - the Hubble constant. It is evident from Eq. (12.66) that r_n appears normalized on the average distance between the galaxies $\tilde{L}$. Then we obtain:

$$r_n = \int_0^z \frac{x}{\ln(x+1)}dx \qquad (12.69)$$

The expression (12.69) provides the relation between the normalized distance to a distant galaxy and the measured z-shift. The equation (12.69) can be regarded as a theoretical expression of the Hubble plot.

Equation (12.69) is calculated numerically and plotted in Fig. (12.54) in a log-log scale and in Fig. (12.56) in a log-lin scale. Figure (12.54) is plotted in a same scale like the Fig. (12.53), for comparison with the shown experimental Hubble plot. For the same reason Fig. (12.56) is plotted in a same scale like the Fig. (12.55) for comparison. The derived theoretical equation of the Hubble law is in excellent agreement with the experimental data. (For a fitting test the theoretical plots can be copied and past over the experimental data).

12.B.13.7 Experimental evidence about the inhomogeniety of the Universe

Some of the experimental evidences about the inhomogeniety of the Universe has been discussed:

- The lower Maxwellian energy in the Globular Clusters discussed in §12.B.7.2.1
- The red shift periodicity discussed in §12.B.4.2.5
- The quasar phenomenon as a pipe between two CL spaces with different ZPE immersed in a host galaxy CL space
- The Lyman alpha forest phenomenon discussed in §12.B.12.

One additional phenomenon which might be explained by inhomogeniety is discussed in the next paragraph.

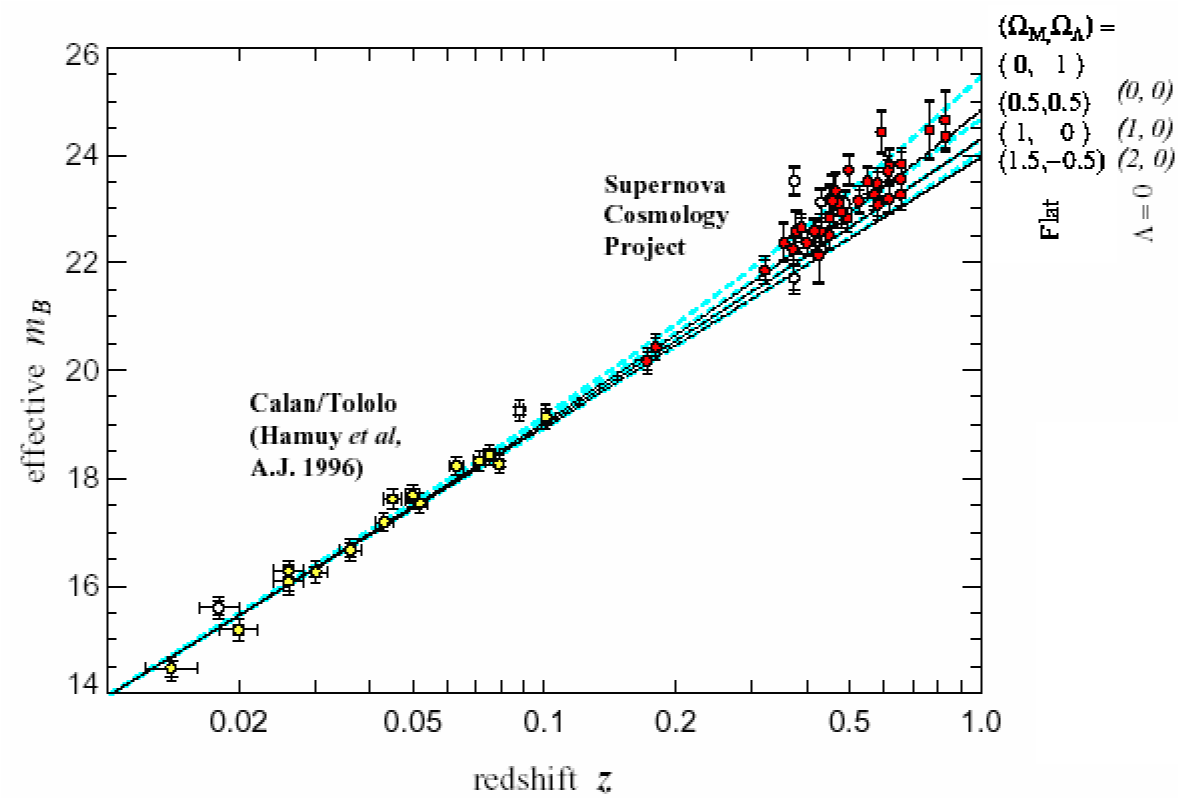


Fig. 12.54. Hubble plot for 42 high red-shifted Type Ia supernovae. Courtesy of Perlmutter et al., Astrophys. J. 517: 555-586, 1999; available also in http://laml.arxiv.org: astro-ph/9812133

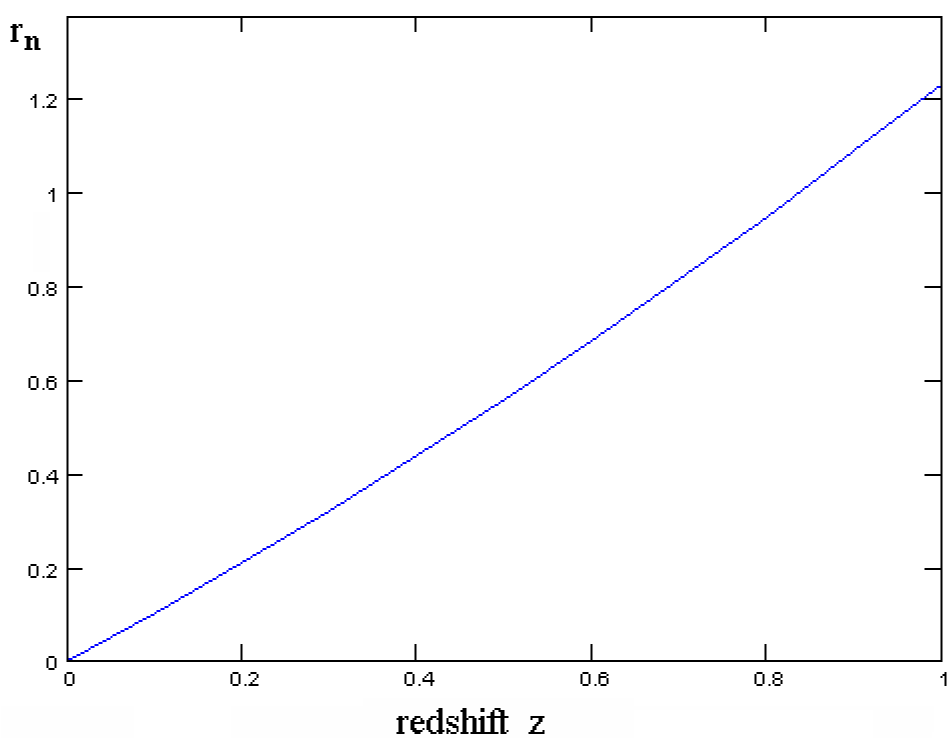


Fig. 12.55. Theoretical Hubble plot

$$r_n = \int_0^z \frac{x}{\ln(x+1)} dx$$

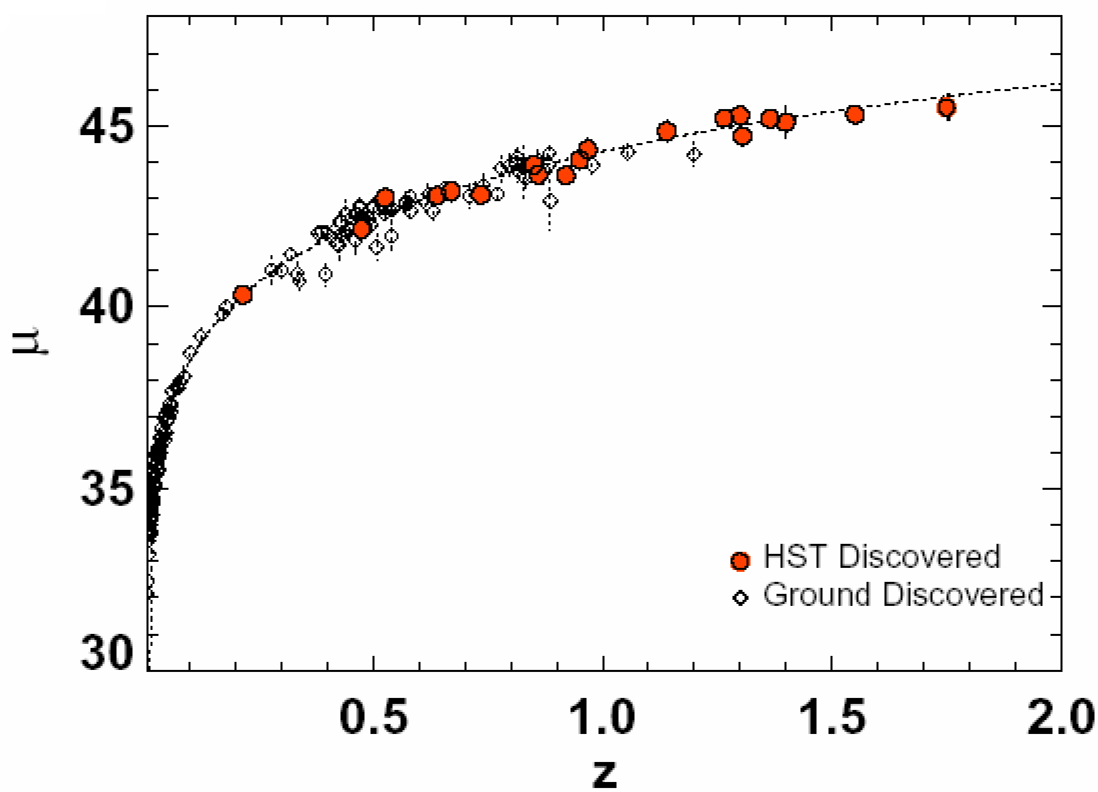


Fig. 12.56. Courtesy of A. G. Riess at al, Astrophy. J., 2004 (in press), available in http://arXiv.org/abs/astro-ph/0402512

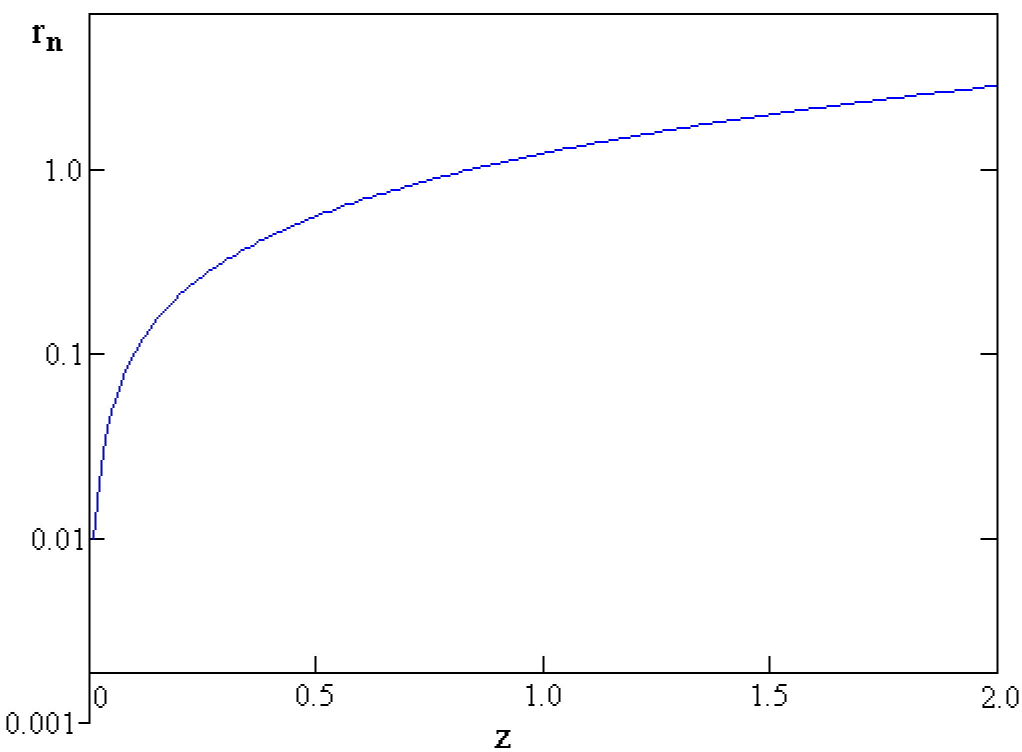


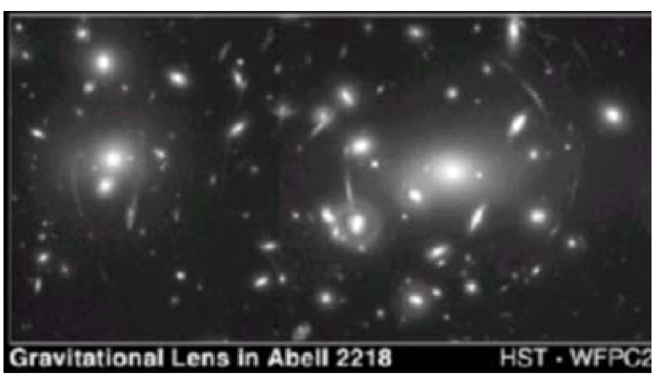
Fig.12.57. Theoretical Hubble plot

$$r_n = \int_0^z \frac{x}{\ln(x+1)} dx$$

12.B.13.7.1 A lensing effect from a globular cluster or abnormal small galaxy.

The Globular Clusters (GC) are formed during the galaxy collapse and they survive the hidden phases of the matter evolution. They posses own CL space, but they don's have a bulk nucleus as the normal galaxies. This is the main reason for their lower total (Maxwellian) energy. They are spread during the galactic birth (eruption), so the probability for some of them to be thrown in a neighbouring galactic CL space is not excluded. The matter of a migrated GC may find less optimal quantum operational conditions in the neighbouring galaxy space than in the host one. This is a result of a possible larger difference of the prisms diameter/length ratio. Then the migrated GC in a neighbouring galaxy may exhibit a lower maxwellian energy in comparison to the GSs in the home galaxy. The GSS of a such GC will exhibit a **large difference of it quasirefractive index** (positive or negative) in respect to the home galaxy. In such conditions the spherical shape of the migrated GC could be able to provide a detectable lens effect. We may call this a **GC lens effect**.

The image shown in Fig. 12.58 illustrates a lens effect, referred so far as a gravitational lens. According to the BSM interpretation it might be caused by a GC or a small galaxy with a lower quasirefractive index. The shape of the GSS of the globular cluster may not be perfect spherical. The shown lensing effect might be of such a type.



PF 95-14 St Scl OPO Apr 5 1995 W Couch (UNSW) NASA

Fig. 12.58

The observed by HST lens effect, which might be caused by a GC or a small galaxy with a large quasirefractive index difference in respect to the host galaxy.

The GC lens is quite distant from the telescope, so the imaging objects are in infinity. It is equivalent to put a negative lens in front of the telescope, but in some distance from it.

The observed phenomena has been considered so far as example of gravitational lensing. The BSM arguments against such interpretation and in favour of a GC lens effect are the following:

(a) The refractive index of the gravitational type of lensing is defined by the Newton's gravitational law. So it must be of gradient type

(b) The quasirefractive index of GSS from GC could be only of a step like gradient.

(c) The gravitational type of lensing is of positive type. It is well known from the optics that such type of lensing exhibits large spherical aberrations

(d) The GC lens is of negative type. The combination of such lens with a telescope exhibit much smaller spherical aberrations.

(e) The negative type could be distinguished from the positive type of a spherical lens by the aberrations and distortions of the image.

(f) The negative type of lensing could also be identified by the changed cosmic microwave background (see the BSM concept of CMB in Chapter 5).

According to above arguments, the image from globular cluster GSS will be equivalent of image of spherical lens of glass "1" with a low refractive index immersed in an optical glass "2" with a higher refractive index. The object source and the detector are both in the glass "2". The concept can be easily verified by optical ray tracing program.

Some small elliptical galaxy shows features quite similar to the globular clusters. If some smaller galaxy had lost its galaxy nucleus (due to a migration or spatial separation) its maxwellian energy will be decreased as the GC. In the same time its CL space is still connected to its neighbours. The space of such galaxy, that could be quite distant from the Milky way, may provide a similar lens effect.

The BSM concept of GC lensing could be demonstrated by simple practical experiment. A hollow plastic sphere is immersed in a vessel filled by water. Coins are put in the bottom of the vessel. A simple eye observation shows the effect of image distortion. One major difference in the proposed simple experiment is that the refractive index of water (1.333) is pretty different than the refractive index of air. In case of GC lensing the difference is much smaller (below 1 %). However the possible lensing effect in the observable universe could be apparent because the GC (or low energy galaxy) could be at enormous distance from the telescope and the imaged galaxies could be also much far away.

12.B.14. Stability of the Cosmic Lattice structure

One of the amazing feature of CL structure is its stability. It means, that any temporal destruction of this structure is immediately repaired. This effect is subordinated by the IG forces and the intrinsically small time constant of the IG types of interactions. These are kind of transition processes for CL space, which may be invoked only by very fast and strong interactions. Such interactions take place, for example, in the the atomic coliders when FOHSs are destroyed. In this case a large energy appears providing infinities in the Feynman diagrams. But where this energy does come from? The possible answer is: It is extracted from the CL space. The destructed FOHS causes a temporal local change of the static CL pressure, which is equalized by the CL space in an extremely fast way. The speed of the process is controlled by the high frequency parameters of CL space. The time-space constant, used also as a CL space relaxation time is obviously involved in such transition process. The nuclear weapon causing a massive fission or fusion reactions is one of the most violent destruction of CL structure, but it is still repaired (fortunately). The huge energy effect comes again from the CL space. One interesting fact deserves attention: we get energy from both type of reaction: fission (nuclear depletion) and fusion (nuclear synthesis). This means that CL structure reacts on both action: local abnormal increase or decrease of the static CL pressure. The invoked IG waves in such reaction cause a large production of gamma waves from the CL space. Consequently the CL structure is in very strict balance. But any energy balance requires at least two separate components. What are these components of CL space? The possible answer is: **The two energy components are the energies of the left and the right handed node systems. This means that despite the alternative arrangement of the lefthanded and right handed nodes in the CL space they are connected pretty strongly.**

Having in mind the difference between G_{OS} and G_{OD} we may consider the total energies of left handed nodes and right handed nodes as separate energy components. So we may regard the CL system as comprised of two subsystem with their individual total energies. Then the mean energy of any individual node of normal CL space may posses energy proportional to its fraction in the subsystem it belongs. If considering a free space (without particles) then we may expect that a sudden change of the static CL pressure in some spatial domain is distributed as interaction energy faster in the same handedness node system than between them. Then the final effect of the static pressure change could appear as restoration of the energy balance between the both subsystem. The secondary effect of such restoration should be an emission of neutral gamma waves. The predominant energy released in the case of a nuclear explosion is perhaps in a form of such type of radiation. So we may accept that the right and the left handed parts of the CL structure posses **own individual subsystem energy level**, the sum of which provides the total energy of the system. In a normal CL space both subsystems have equal total energies.

According to the concept developed in §12.A.4.3.3. the total energy of the susbsystem is the internal vibrational energy in all vibrational modes of the low level structures included in the prisms. It should be in balanced conditions with the saturation energy level and the IG interaction energy. According to this balance and the energy limiting conditions of the saturation level it is reasonable to expect that any change of the balance could involve a slight change of the IGSPM frequency or at least its phase. But then a condition for IG repulsion may occur in a similar way described in §12.A.8.2. CL space structure, however, is very well spatially distributed, due to conditions created by the magnetic protodomains and the zero point waves. Consequently the time-space parameter (or relaxation constant) t_{CL} should be involved in a mechanism of proper IGSPM frequency or phase change. So we may accept that a suitable frequency or phase change of IGSPM vectors of both subsystems might keep a zero gravity between the neighbouring CL nodes of different type, **but only for well defined node distance**. Then we arrive to the following conclusion:

The distance between neighbouring nodes in CL space is self adjustable in order to keep the proper phase or frequency of IGSPM vector between the opposite type nodes.

The self adjusting mechanism is a finite process in which the time-space constant t_{CL} **is involved**

The self adjusting node distance mechanism does not disturb the NRM and SPM vectors whose periods are much shorter than the time-space constant t_{CL} **(CL space relaxation time).**

The group dynamical behaviour of the CL nodes and the Zero Point waves assure the constancy of the two important parameters of the physical vacuum: the permittivity and permeability of the free space.

12.B.15. A new life for the Ether concept of the space in which we live and observe

The vision of some great physicists about the space (physical vacuum) is different from the currently adopted concept. Michael Faraday and James Maxwell, on which equations the modern electrodynamics relies, have been rigorous supporters of the Ether concept. In A Treatise on Electricity and Magnetism vol. II James Maxwell concludes on the last page in favor of the Ether:

"**.....whenever energy is transmitted from one body to another in time, there must be a medium or substance in which the energy exists after it leaves one body and before it reaches the other**"

Attacking the opponents of his concept Maxwell say: **My further researches lead me to find that these 'eminent men' who take upon themselves the task of ignoring anything that contradicts their cherished beliefs, follow what is called Scientism. And Scientism is well known by some people as a corruption of Science that is really a 'pseudo religion.' With so many 'eminent men' following their religion of Scientism and pretending it to be Science, it is little wonder that the world is in a very 'sorry state' of affairs.**

In most of the standard modern physics textbook it is written that Einstein disproved the Ether (aether) when it talks about the Michelson Morley experiment. However, if you look at the book: Sidelights on Relativity - Einstein says he did not disprove the ether, just showed that one version of it was wrong [2]. Furthermore, in a publicly documented motion (the movie clip is now available) Albert Einstein claims: **To deny Ether is ultimately to assume the empty space is not (with) physical quality. The fundamental facts of (Quantum) Mechanics do not harmonizes with this view. According to the General Relativity, space is embodied with physical quality. In this sense, therefore, there exists Ether. According to General Relativity, space without Ether is unthinkable.**

Really the "ether" concept evolved in General relativity and became called "space-time." But that interpretation gets lost in confusion as people try to think from the formulated postulates in Quantum Mechanics, and they reinterpret General relativity in a wrong way. In fact Einstein did not agree with the 1925 theory of Quantum Mechanics [1,2,3]. Today physicists are taught that the 'ether' concept is nonsense, but in fact the natural media or "ether" in Quantum Mechanics is replaced by some of its attributes, such as: quantum fluctuations of the physical vacuum, vacuum polarization, zero-point energy, space-time metrics and other names [1].

The adopted formulation about the space-time created a paradox that we have to study the properties of something real while the existence of the carrier of these properties is denied. Presently, it is assumed that the vector forms of the Maxwell's equations describe entirely the EM field properties of the physical vacuum. Maxwell, however, suggested his equations in quaternion form that according to some recent analysis allows prediction of scalar (or longitudinal) waves. The existence of such waves is in a favor of the Ether concept. Nikola Tesla, shearing the Maxwell's vision about the space and talking about it as a natural medium, provided experiments unexplainable from a point of view of the Modern physics. Today many of his experiments became replicated and the effects described by him are confirmed.

Apart of the discussed in this chapter cosmic paradoxes that are enigma for the Big Bang theory experiments exist confirming the absoluteness of the space in favor of the stationary Universe. Prof. Stefan Marinov, for example, proposed two laboratory experiments for measuring the velocity of the Earth through the absolute space. These experiments overperform methodically and technologically the classical Michelson Morley experiment made 100 years ago. In the second experiment published in the article "Measurements of the Laboratory's Absolute Velocity (General Relativity and Gravitation, Vol. 12, No. 1, 1980) Stefan Marinov successfully measured the velocity of the Earth rotation around the Sun and the solar system rotation around the Milky way galaxy centre with unprecedented accuracy. His first experiment performed in 1976 is published as "The interrupted "rotating disc" experiment" in J. Phys. Math. Gen, 16 , p. 1885-1888), (1983). This experiment has been repeated and the results are confirmed by E. W. Silvertooth, sponsored in part by Air Force Systems Command, Rome Air Development Center, Griffiss AFB and the Defence Advance Research Projects Agency. E. W. Silvertooth, Experimental detection of the ether, Spec. in science and Tech. Vol. 10, No 1, p. 3.(1986).

The Earth motion is detected also by the anisotropy in the blackbody radiation (G. F. Smoot, M. V. Gorenstein, R. A. Muller, Phys. Rev. Lett. **39**, 898 (1977)).

The Earth motion is also detecting by the VVLBA technique. The following extract is from the website of the National Radio Astronomy Observatory
(www.nrao.edu/pr/1999/sagastar/)
"Whit this precision, the astronomers were able to detect the slightest apparent shift in position of Sagitarius A* compared to the positions of much more -distant quasars behind it. This apparent shift was caused by the motion of the Solar System around the Galaxy's center. "From these measurements we estimate that we are moving ar about 135 miles per second in our orbit around the center of the Milky Way", Reid said. "Even though it take more that 200 million years for us to complete an orbit of the Galaxy's center, we can detect this motion in ten days, observing with the VLBA!".