O‘ZBEKISTON MILLIY UNIVERSITETI XABARLARI, 2024, [1/7]
ISSN 2181-7324

FALSAFA
http://journals.nuu.uz
Social sciences

UDK: 524

Salakhutdin NURITDINOV,
Professor of National university of Uzbekistan
E-mail: nur200848@mail.ru
Sobir TURAEV,
PhD student of National university of Uzbekistan
E-mail: sobr8488@mail.ru

O‘zRFA Astronomiya instituti professori K.Mirtadjiyeva taqrizi asosida

PROBLEMS OF THE ACCELERATING EXPANSION OF THE UNIVERSE

Annotation

Observational data from the James Webb Telescope pose significant challenges to the ΛCDM model. This could lead to significant changes to the standard model. The accelerated expansion of the Universe is associated with the redshift of distant objects, and standard cosmology assumes that this redshift is caused by cosmological expansion. In this paper, we consider the alternative possibility that the redshift of distant objects may also be due to the phenomenon of redshift of light in the intergalactic and interstellar media.

Key words: Accelerating expansion, cosmology, intergalactic medium, interstellar medium, modeling, redshift.

О ПРОБЛЕМЕ УСКОРЯЮЩЕГОСЯ РАСШИРЕНИЯ ВСЕЛЕННОЙ

Аннотация

Данные наблюдений телескопа Джеймса Уэбба представляют собой серьезные проблемы для модели ΛCDM. Это может привести к существенным изменениям в стандартной модели. Ускоренное расширение Вселенной связано с красным смещением далеких объектов, и стандартная космология предполагает, что это красное смещение вызвано космологическим расширением. В этой статье мы рассматриваем альтернативную возможность того, что красное смещение далеких объектов также может быть связано с явлением красного смещения света в межгалактической и межзвездной среде.

Ключевые слова: Ускоряющееся расширение, космология, межгалактическая среда, межзвездная среда, моделирование, красное смещение.

KOINOTNING TEZLANISH BILAN KENGAYISHI MUAMMOLARI

Annotatsiya

Jeyms Webb teleskopidan olingan kuzatuv ma’lumotlari ΛCDM modeli uchun jiddiy qiyinchiliklar tug‘diradi. Bu standart modelda sezilarli o‘zgarishlarga olib kelishi mumkin. Olamning tezlashtirilgan kengayishi uzoqdagi jismlarning qizilga siljishi bilan bog‘liq va standart kosmologiyada bu qizilga siljish kosmologik kengayish tufayli yuzaga keladi deb taxmin qilinadi. Ushbu maqolada biz uzoq ob'ektlarning qizilga siljishi ham galaktikalararo va yulduzlararo muhitda yorug‘likning qizilga siljishi fenomeni bilan bog‘liq bo‘lishi mumkin bo‘lganmuqobil imkoniyatni ko‘rib chiqamiz.

Kalit so‘zlar: Tezlanuvchan kengayish, kosmologiya, galaktikalararo muhit, yulduzlararo muhit, modellashtirish, qizilga siljish.

Introduction. Observing very young massive objects with JWSP poses significant challenges for modern cosmology. In this case, it is useful to introduce new alternatives to standard cosmology and increase the demand for existing alternatives. The new model of the Universe proposed by Perlmutter and his co-authors [1,2] is known to be expanding with acceleration, which was established by them on the basis of observations of type Ia supernovae (SNe Ia) in distant galaxies and the discovery of regular deviations of distances to them from Hubble's law towards them increase. However, without disputing in any way the possibility of the existence of dark energy in the Universe, it is useful to look for an alternative to its expansion with acceleration, if only because the processing of observational data and the calculations of the above authors need clarification on a number of factors. Riess et al. considered some factors of affecting the distance modulus, including effect of a Local Void-very small, Weak Gravitational Lensing, Evolution, Extinction and Light Curve Fitting Method [1]. They consider that all these factors cannot explain for the 0.28m difference in the template-fitting SNe Ia distances and the $\Omega_\Lambda=0$ prediction. Among them, the procedure for determining the distance to a light source requires special attention, since a natural question arises: is the regular deviation of distances related to the effect of a decrease in the brightness of supernova light as it moves in intergalactic space and inside our Galaxy?

Let us first turn to the results of modern observational data performed on the Hubble Space Telescope and large ground-based telescopes. These results show that the understanding of the physical state, structure and distribution of baryonic and dark matter in intergalactic space today is clearly far from the concept accepted in [1,2], and only now we have deep observations indicating a patchy structure of the distribution of these types of matter in intergalactic space. An example is the work of Whitaker et al. [3], where in the redshift interval $0.5<z<2.5$ young galaxies and systems of globular clusters of stars were found inside dark matter in Coma Berenices [4]. Both articles [3,4] were written based on the results of research in 2017. If several dark dwarf galaxies were previously known, now dark spiral galaxies have been discovered [5]. The work of Farrah et al. [6] even discovered super-luminous infrared galaxies with a redshift of $1.5 < z < 3$ inside a dark matter halo with a mass of 6 × 1013 MΘ. These super-luminous infrared galaxies are likely the precursors of galaxy clusters or superclusters. Thus, if stars in the Milky Way are born in dark molecular clouds, then it turns out that protogalaxies and young galaxies should be sought within dark matter. The complex, patchy structure of intergalactic matter, which may contain protogalaxies and other types of baryonic matter, suggests that neglecting the effect of weakening the brightness of distant supernovae in intergalactic space, and especially in our Galaxy, is generally unacceptable.

Alternatives to the cosmological redshift. Masanori Sato [7] proposed an alternative interpretation of the theory of the accelerating Universe using experimental data on redshift. At small z (<0.1), there is no slowdown in the width of the light curve. At large z (> 0.1), a slowing down of the width of the light curve appears. We know Zwicky tired light mechanism based on gravitational redshift is proposed for a diffusion-free and dispersion-independent frequency redshift mechanism.

Although Tired Light Theory is mainly suggested for the static Universe, however, this theory could be attached to the expanding Universe (non-accelerating). Partial correctness of the theory may also damage to the existing standard model. In Tired light theory, redshift is caused not by the cosmological expansion, as in the ΛCDM model, but by the loss of a portion of photon's energy during the intergalactic motion. This loss may be owing to electrons, neutral hydrogen and other substances in the intergalactic medium. Accordance with New Tired Light (NTL) oscillating electrons in the intergalactic environment absorb and reproduce photon, resulting in reduced its energy, wavelengths, and redshift [8]. As photons irradiated by intergalactic electrons are coherent, light cannot dim (interference is not observed). Current intergalactic medium models contend that it's mass density: ρM ≈ 10−27 kg/m3. Using identic electron number density, n ≈ 0.498 giving a mean free path of 7.13×1021m. If redshift due to interaction between photon and intergalactic medium matter it can't be used it in calculations. Then this result may be sufficient to damage to the SNe Ia cosmology calculations.

Frank R. Tangherlini developed an alternative theory for the expansion of the Universe with acceleration. This theory doesn't keep out the existence of dark energy, although opposed to acceleration, but assumes that there is no negative compressive force (no acceleration) [9]. At z = 1.65 ± 0.15, the Universe expansion coincides with a non-accelerating period [10]. In another paper [11], when z ≈ 0.5, the visibility of SNe Ia fits to the maximum brightness. This theory opposes the accelerating expansion by supporting the expanding Universe.

The Timescape cosmological model [12] was supposed as a potentially vital Smale & Wiltshire alternative to homogeneous and accelerating model with fluid-like dark energy. This model considered that the redshift value could be greater in Voids, and less in intergalactic and interstellar medium. At present, about 40-50% of the universe is in voids of order 30h−1 Mpc in diameter. According to observations of voids, the present epoch Universe is inhomogeneous on scales below the BAO (Baryon Acoustic Oscillation) in scale of 100h−1 Mpc, while exhibiting the density difference of order 8% in density for sample volumes larger than this scale [13,14]. Timescape cosmology predicted the values that are comparably low at 61.7 ± 3.0 km s−1 Mpc−1, being a non-linear average of 50.1 ± 1.7 km s−1 Mpc−1 for walls and an apparent maximum of $75.2^{+2.0}_{-2.6}$ km s−1 Mpc−1 across voids [51].

Photon transmission in different media. The effect of partial loss of radiation in intergalactic and interstellar space occurs in completely different ways and is cumulative in nature, as a result of which it is lost through absorption. A"(r) > 0 in units of magnitude m, which directly enters into the expression for the "absolute magnitude" of the supernova at the moment of its maximum brightness

$$M_{max} = m_{max} - 5lgr - \mathrm{A}^{m}(r), \qquad (1)$$

Moreover, the value Mmax = -19m.07 (filter B) was established for many supernovae. Formula (1) makes it possible to determine the distance r to the supernova (i.e. to the galaxy), if only we know the value of the total absorption A"(r) in a given direction, which is not a simple task. Note that the authors of [1,2] it is believed that there is a critical value of redshift zcr = 0.7, and for zcr > z the light source is in a state where the Universe was expanding at a slower rate and in this case absorption can be neglected. However, in our opinion, the absorption effect must be taken into account regardless of the value of redshift of the supernova. These authors determine the absorption value using an approximate formula known in stellar astronomy, where excess color is involved [3,4]. Numerous calculations of the value known in the literature show that its value depends not only on the type of objects, but also on the direction in. our Galaxy. In this regard, below we present another way to calculate the absorption effect.

In (1), the value of the absorption function Am(r) is determined by the absorption coefficient a(r), which in general depends on the distance r and consists of at least two parts: interstellar ais(r) and intergalactic aig(r) coefficients absorption, i.e.

$$\mathrm{A}^{m}(r) = \int_0^r a(r)dr = \int_0^R a_{is}(r)dr + \int_0^r a_{ig}(r)dr = J_S + J_G, \qquad (2)$$

where R is the distance from us to the boundary of the characteristic size of our Galaxy in the observed direction, which is a function of galactic latitude b.

Analysis of observational data assessing the absorption of light in various directions in the Milky Way shows that the magnitude of absorption is maximum in the equatorial plane of symmetry of our Galaxy and decreases rapidly with increasing galactic latitude b. The Sun is located just near this plane, along which the gas-dust layer of matter is located, since the Galaxy is a system flattened along the z-coordinate with a mass concentration towards this plane. The absorption coefficient aig(r) is proportional to the distribution density of the gas-dust layer, for which the barometric formula is a fairly good approximation

$$a_{is}(r) = a_0\, exp(\frac{-z}{\Delta}) = a_0\, exp(\frac{-rsinb}{\Delta}), \qquad (3)$$

where a0 is the absorption value in the plane itself, ais is the characteristic half-thickness of the substance layer. Therefore, in (2)

$$J_S = \frac{a_0\Delta}{sinb}\left[1 - exp(-\frac{rsinb}{\Delta})\right] \qquad (4)$$

According to observations, a0 = 2.m23 ± 0.m19, ~ 100 pc, and the value of R depends on b.

As for determining the value of JS, today this task seems quite difficult due to the lack of observational data and requires, first of all, an analysis of the distribution of gas-dust matter in galaxy clusters and superclusters, since it is believed that electromagnetic radiation interacts very weakly with dark matter, in dense areas in which accumulation of ordinary, observable matter occurs

To estimate the average value of JG in (2), you can use the normal density distribution

$$a_{ig}(r) = \bar{g}_0 N \sqrt{\frac{a}{\pi}}\, exp(-ar^2). \qquad (5)$$

here $\bar{g}_0$ is the average value of the absorption coefficient in a galaxy cluster, N is the number of clusters in a given direction, a is the proportionality coefficient Substituting (5) and (2) and representing the integral from R to r as the difference of integrals for the intervals [0, R] and [0, r] we find that

$$J_G = \frac{1}{2}\bar{g}_0 N[(\Phi\sqrt{a}r) - (\Phi\sqrt{a}R)], \qquad (6)$$

where Φ is the symbol of the special function "probability integral". A more accurate estimate of the value obviously requires the accumulation of observational data and the implementation of appropriate additional analysis.

Conclusion. Redshift is a very important concept in astrophysics. It explains the expansion of the Universe and determines the distances to distant objects. In standard cosmology, the cosmological redshift is assumed to be related to the cosmological expansion. But there are a number of alternatives to the occurrence of redshift. In this work, we propose that light experiences external influences as it passes through different media and that the cosmological redshift arises from the absorption and re-emission of light in the intergalactic and interstellar medium. There are a number of alternatives for the origin of the redshift. We assume that the redshift is caused in part by the absorption and re-emission of photons in the interstellar and intergalactic medium, and modulate the passage of light through various media. We need further research to draw a definitive conclusion on our supporting proposal, and we will develop our results in future work.

REFERENCE

1. Adam G. Riess et al., Observational evidence from supernovae for an accelerating Universe and a cosmological constant, Astrophysical journal, 116:1009-1038, 1998 September, p.1009,1020, 1028-1034
2. S. Perlmutter et al., measurements of Ω and λ from 42 high-redshift supernovae, The Astrophysical Journal, 517 : 565È586, 1999 June 1

3. Whitaker, Katherine E et al., Predicting Quiescence: The Dependence of Specific Star Formation Rate on Galaxy Size and Central Density at 0.5 < z <2.5, The Astrophysical Journal, 838:19 (19pp), 2017 March 20
4. Pieter van Dokkum et al., Extensive Globular Cluster Systems Associated with Ultra Diffuse Galaxies in the Coma Cluster, The Astrophysical Journal Letters, 844:L11 (7pp), 2017 July 20
5. Pieter van Dokkum et al., A high stellar velocity dispersion and ∼100 globular clusters for the ultra-diffuse galaxy dragonfly 44, The Astrophysical Journal Letters, 828:L6 (6pp), 2016 September 1
6. D. Farrah et al., Ultraluminous Infrared Galaxies at 1.5 < z < 3 Occupy Dark Matter Haloes of Mass ∼ 6 × 1013M⊙ , ASP Conference Series, Vol. 380, 2007
7. Masanori Sato, Tired Light: An Alternative Interpretation of the Accelerating Universe, 20181225 Revised, 20 Oyamazuka, Oiwa-cho, Toyohashi, Aichi 441-3193, Japan, 2019, p.2
8. Lyndon E Ashmore, Calculating the redshifts of distant galaxies from first principles by the new tired light theory (NTL), IOP Conf. Series: Journal of Physics: Conf. Series 1251 (2019) 012007, p.1
9. Frank R. Tangherlini, A Possible Alternative to the Accelerating Universe I, II, III, IV, Journal of Modern Physics, 2015, 6, 78-87; 2015, 6, 1360-1370; 2016, 7, 1829-1844; 2017, 8, 622.
10. Riess A. G., et al., The farthest known supernova: support for an accelerating Universe and a glimpse of the epoch of deceleration, The Astrophysical Journal, 560, 49-71. 2001, p.49.
11. Tonry J. L., Cosmological results from high-z supernovae, The Astrophysical Journal, 594, 1–24, 2003, p.2
12. David L Wiltshire, Cosmic clocks, cosmic variance and cosmic averages, New Journal of Physics 9 (2007) 377, p.3
13. David W. Hogg et al. Cosmic homogeneity demonstrated with luminous red galaxies. arXiv:astro-ph/0411197v1 8 Nov 2004, p.1
14. Sylos Labini F. et al. Testing the Copernican and Cosmological Principles in the local Universe with galaxy surveys, arXiv:1006.0801v1 [astro-ph.CO] 4 Jun 2010, p.1