Tired light hypothesis got second direct confirmation from supernova apparent magnitude change as a function of red shift. No need for “dark energy”.

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Abstract.

For the long time the idea of Big Bang and expanding Universe was predominant in physics community. While originally tired light idea was expressed by Hubble himself it was rejected by others due to mainly two factors: all existing mechanisms of photon scattering would lead to one-step light scattering, image blurring and thus even close galaxies are not possible to observe [1] and the dispersion of the red shift was exactly proportional to energy and the only mechanism known at that time with precisely that dependence was Doppler mechanism. Thus the idea of Big Bang was born and eventually lead to the present situation: James Webb Space Telescope discovered galaxies presumably very young (300 millions years from Big Bang point of view) but with stars at least as old as 2 billions years old (from well established theories of star ageing and metallicity laws well confirmed in close areas of Universe). Essentially very young galaxies consist from start as old as Sun or even older. This is the most striking contradiction in addition to the absence of Tolman effect and presence of what seems to be active galactic nuclei in the young galaxies, presence of already dead galaxies in “early” Universe, too high metallicity and other phenomena [1]. Recently the idea of scattering of photons being implemented in enormously small steps was proposed [1] and that lead to explanation which easily describes red shift with almost unnoticeable scattering for close galaxies (energy drain proportional to N number of interactions but change of angle proportional to sqrt(N) and for huge N light scattering is not easy to observe for close objects). However, despite very small, light scattering and image blurring should be present in images of very far objects and this phenomenon was indeed present in images made by James Webb Space Teelescope [1]. The same scattering must be also visible for the closer but smaller objects like supernovas and indeed retro-analysis of supernova 1a light curves (standard candles) as function of distance confirms the model outlined in [1] to some extent.

Introduction.

Tired light hypothesis was proposed even before the Big Bang hypothesis and seemed quite natural – indeed, the light observed to become reddish when scattered [2]. Eventually this idea was removed because of many problems it has. At first, older rejections applicable to infinite and eternal Universe model:

1.If Universe is infinite where is the light from infinite number of stars (it should be shining all over the sky). Actually this Olbers paradox is resolved in tired light idea – microwave radiation with Plank curve and temperature of 2.4 K is the answer – if light is slowly losing the energy it is eventually thermalized and create the shining from all the directions – exactly Olbers paradox but for different wavelength (not visible light).

2.If Universe is eternal why the stars are still shining – they should be all transferred into energy (light and fields and elementary particles) and black holes and neutron stars. Newest discoveries in nuclear physics actually have a key to solution: at first the space is filled with extra-high energy particles (say 2 GeV) and at second the two-protons decay was predicted and discovered in the middle of 20th century (presently three-protons decays are discovered too) [3]. It means that the high energy particles like 2 GeV virtually smash the high mass nucleus like iron into the protons, neutrons and alpha particles which at further reactions are converted into hydrogen and helium which are ready to be assembled slowly into the giant gas planet and one day ignite as a new star. Provided the energy conservation law holds the energy in Universe is oscillating between energy (like light and particles) and usual matter capable to ignite the stars again – energy cycle is present very much as water cycle on Earth (and galaxy is open system indeed, the particles are accelerated to enormous energies somewhere in inter-galaxy space).

Tired light rejections of 20th century are mainly those:

1.If light is scattered why we see galaxies at all? And space telescopes may see them so far away that seemingly no light scattering is present at all (exact mathematical null). This rejection is of course valid for all known mechanisms of light scattering including Compton scattering. However, if a new mechanism is proposed (and it needs a New Physics indeed [1]) it may explain why light is losing energy without scattering (up to certain level, at which the scattering is finally directly observed).

2.The dispersion of red shift (frequency dependence of red shift) is absolutely exactly corresponds to Doppler effect already for more than one order of magnitude (James Webb Space Telescope recorded spectroscopical lines with Z=13, which have only 1/14 of initial energy and the red shift is still exactly proportional to energy). Any possible mechanism of energy loss must be different from so simple linear dependence and even if by accident it is approximately proportional to energy for some energy range it can not be possibly so accurately proportional for so high span of energies. This is indeed the strongest argument for Doppler like mechanism of light red shift and may be only challenged in the future (may be for next order of magnitude energy shift finally the deviation from linear dependence will be observed – the restored spectra will stop correspond exactly to the spectrum of say Sun, some shifts of line positions will be finally observed). Again, there is no way this may be easily explained with modern physics, new physics would be necessary.

On the other side, the Big Bang already had a lot of problems with far galaxies (absence of Tolman effect [4]) even with Hubble space telescope. James Webb Space Telescope not only exacerbated this old problem [5] but created a lot of new problems mainly concerning with too many too old too large galaxies which all looks way too mature to pretend on the role of just formed by Big Bang. The desperate attempt to safe Big Bang is to invent another dark stuff (in addition to dark matter and dark energy) – primordial black holes which were formed before the galaxies and allowed them to be formed virtually instantly and very mature or even dead (with stopped star production). That would create almost all very far galaxies looked like with huge active galactic nuclei [1], which may be easily explained as demonstration of light scattering. So the tired light hypothesis is back to life (with some modifications, of course, and so far as a hypothesis, more like a hint to where the search should be directed).

Main part.

In [1] direct observation of light scattering was observed for recently discovered far galaxies with Z~13. They looked very similar to what was observed for close galaxies from Earth based telescopes of similar mirror diameter. The origin of bright red spot in the center is obvious for Earth based images – scattering in atmosphere. The difference in image between the Earth based telescope and Hubble space telescope for close galaxies is striking (see [1]). That is why the space based telescopes were such a big hit – no atmosphere, no problems. But James Webb suddenly started delivery of images which looked very similar to images made for close galaxies from Earth (the far galaxies are obviously not visible from Earth at all). How it may be? The hypothesis is that this is another type of light scattering – extremely small and delivered in very small portions (so light should experience billions and trillions of scatterings before it reaches Earth – in this case the energy drain is easily visible – proportional to N, but angle of scattering is much much smaller – proportional to sqrt(N)). This is because of simple application of statistics laws (formulas are in [1]). Yet for very far objects the scattering starts to be visible and allows to evaluate the parameters of such a new type of light scattering (new physics would be necessary, no way it may be explained by usual electromagnetic interactions).

What about closer objects? If light scattering is hardly visible for large objects like galaxies may be it is easier to observe for smaller objects? Indeed, such object exist and well researched – supernova type 1a, the standard candle. And indeed the observed as presence of “dark energy” deviation of the linear dependence of apparent magnitude from z (in corresponding coordinates) may be easily retro-interpreted as influence of light scattering. Once the light is scattered into the cone that should make the object dimmer and thus the apparent magnitude of supernova is larger (the dimmer the object, the larger the apparent magnitude, for Sirius it is minus one and for hardly observed by eye stars is plus 5-6). This is what was observed already and re-interpreted in [6].

For small scattering well below the resolution limit of telescope (for Hubble with mirror or D=2.4 m for green light with wavelength of 500 nm it may be evaluated as $\lambda/D \sim 2*10exp(-7)$) any small closer object will be visible as the dot. In this case it does not any matter, whether the object emanating total energy of J in light have the size of 10 thousands of kilometers of 1 million kilometers in diameter – if it is say away at 1 millions of light years the apparent magnitude of the object will be the same. This is a well known principle why the stars are visible even during day time but in telescope – the resolution of the telescope is not enough to resolve the star (except for telescopes with exceptionally large mirrors and for few close stars) so despite the increase of angle resolution the star is still a dot in the sense of diffraction limit, but the background like sky is spread across and becomes very dim. From formulas in [1] for close stars and galaxies ($z<0.01$) the angle of scattering may be estimated as follows (α is the energy drain at one scattering, N is the total number of scatterings):

$E_N/E_0=(1-\alpha)^N$, angle of blurring ~α*sqrt(N)

The parameter α=2*10exp(-12) (rough estimation made in [1]), $E_n/E_o=1/(1+z)$ (definition of z). Then:

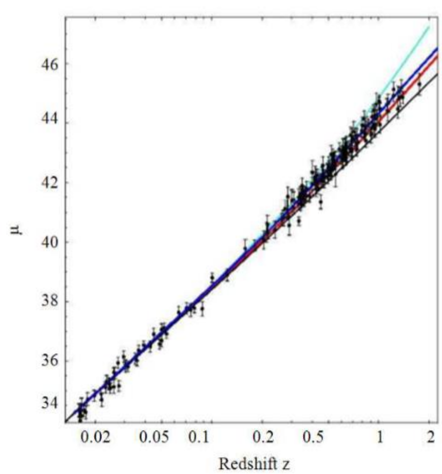
Ln(1/1.01)=-0.01=N*ln(1-α)=-N*α and angle of blurring is 0.1*sqrt(α)=1.4*10exp(-7)

This is below resolution of Hubble and no blurring may be observed directly. Any supernova will be still visible as exactly one dot and no additional dimming of them is possible.

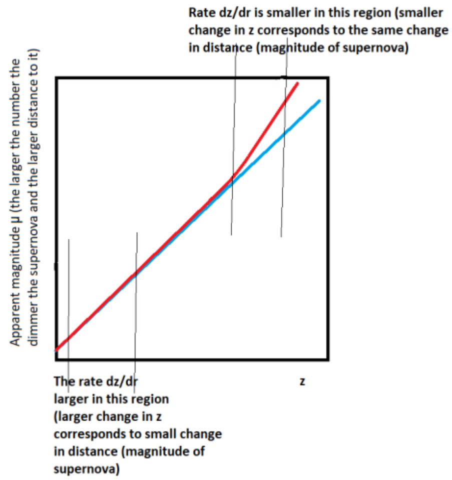
But for Z=1 the situation is different. From the same formulas the angle of blurring is estimated as 1.2*10exp(-6) – six times larger than the resolution of Hubble. In this case the supernova image starts to “spread” in the image and blurs with the background. The apparent magnitude of it is not anymore of exactly one dot in the diffraction limit sense – the object must be looking dimmer (even if the integration is taken around some area).

The observation of the supernova stars relies upon the suggestion that the real size of the explosion is independent of the distance (which is of course, true) and in the absolute absence of any spreading of the light in vacuum the visible size of the supernova explosion will be proportional to 1/R^2 (thus the idea of the standard candle comes to play [8]).

In the case of uniformly expanding universe the magnitude of the peak intensity of type 1 supernovae would be linearly proportional in the corresponding coordinates to the red shift observed (see, for example Fig.9 from [9]). Magnitude expressed as apparent magnitude [10] widely accepted in astronomy - the larger the number the more dim is the light, the brightest stars in the sky have small negative numbers like -1 for Sirius)

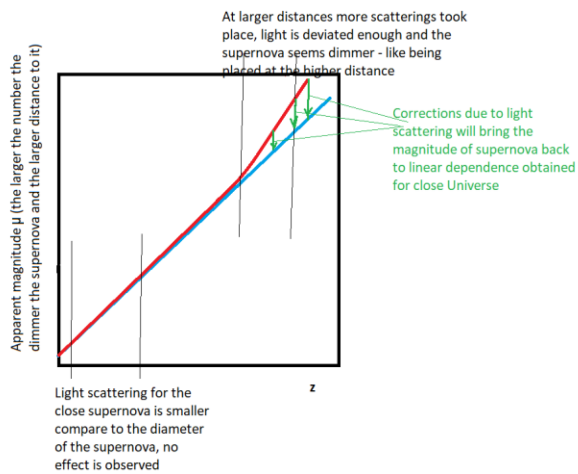


In this figure the experimental values of magnitude μ (proportional to 1/R^2 if no dust or light scattering is present) are plotted in the corresponding coordinates versus redshift z. The linear correlation obtained in Hubble times starts to deviate at higher z, what means (assuming there is absolutely no change in light properties or supernova properties) that the rate of change of z at the close Universe (later times assuming "Big Bang") is higher compare to older times (closer to "Big Bang").



That discrepancy was explained by the presence of "dark energy" which is generated in the most recent Universe (and absent at the times closer to "Big Bang") and accelerates the expansion of the Universe (the value z from Lemaitre times is attributed to the Doppler-like effect, meaning that the universe is expanding). Faster increase of z for the closer Universe means the Universe in the recent time (because the age is measured using relation r=c*t, where c - speed of light is presumed constant not changing with time) is expanding faster (more change on z value for the same time).

How the proposed by Hubble and others theory of tired light may explain the same phenomenon? According to [1] the light emitted by any object (including supernova) is slowly scattered with time (enormously slow, not in one step like Compton scattering, but in billions and trillions of very small steps, see [1]). In this situation the change in energy (energy loss), expressed as z will be observable well before any change of direction is obvious (change of energy is directly proportional to N - number of scatterings, while the change of direction is proportional to sqrt(N) and for huge N it may be very small - well below observation abilities). But eventually the scattering is visible and the **visible** diameter of the bright spot associated with supernova is enlarged perceptibly (the real diameter is of course, the same, the supernova in Milky Way and supernova in the galaxy one billion light years away are exactly the same). Once such a visible diameter is enlarged beyond the telescope diffraction limit, the brightness is smaller and the supernova looks more dim than it is. If this phenomenon is not taken into account the apparent magnitude is larger (value of μ in the figure is larger).



Thus the simple idea of tired light being scattered not once (Compton scattering, original tired light hypothesis) but in very large number may not only easily explain all the problems with far galaxies [1], but also the "dark energy" which in fact is merely the wrong explanation of the observed supernova brightness as a function of distance. This observation in reality is the additional hint toward the nature of light - it is not as simple as piece of electromagnetic wave, it is something else (to be discovered). While in my first publication I advocated the presence of small rest mass of photon [11], in second book the idea of quantized gravitational dipole appeared [12] both those features of photon, despite being possible are still way too small to describe the phenomenon like discovered by James Webb Space Telescope [1]. Most probably photon is even more complex that many scientists believe (non-zero gravitational properties are present like in normal particle). Something even stronger is lingering in photon and much easier to observe (seems like new type of light scattering discovery is right around the corner).

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