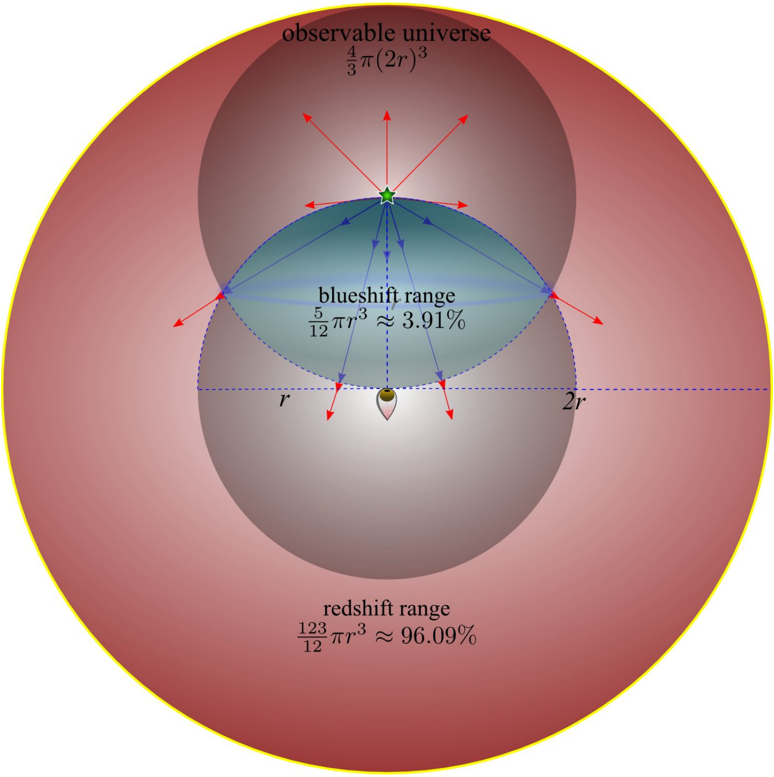
From Redshift To Cosmic Background Radiation

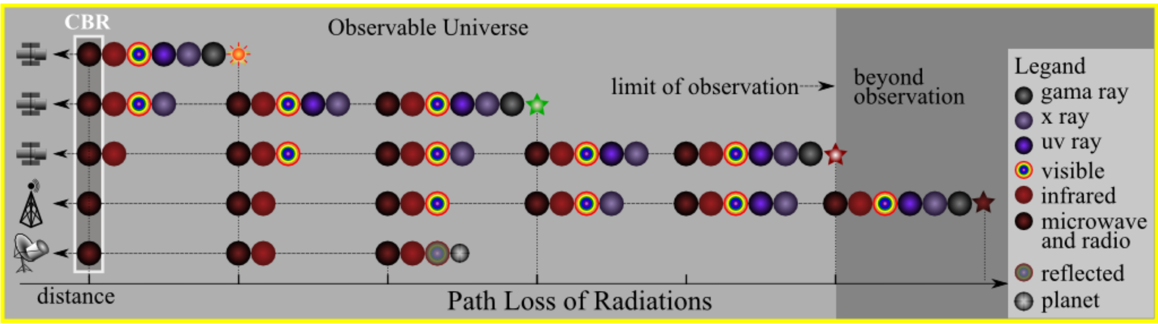
紅移與宇宙背景輻射

Redshift And The Illusion of Big-Bang Universe

Cres Huang



Dominating Doppler Redshift Detection



Dominating Low Frequency Detection (CBR)
Proportional High Frequency Loss Over Distance

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Abstract

The dominating and proportional cosmic redshift has been interpreted as the result of big bang and space expansion. However, it has caused many confusions and paradoxes. If detected redshift are interpreted as Doppler effect, and it is attributed to the space expansion, these assumptions ought to be true:

- Space can expand and there is room for it to expand.
- Space can expand faster than light-speed.
- Space can carry, or it has friction to carry structure as large as galaxies.
- Expanding space does not impose accelerating stress on riding structures.

I believe these facts have been overlooked:

- Space is completely frictionless. It has no surface, and can only be regarded as absolute zero viscosity. Analogous to an infinite vacuum, or endless emptiness.
- All structures have inertia. It will react to acceleration of any kind, self-driven or free-ride. Definitely not faster than light-speed.
- Free-riding raisins are trapped in the dough, they certainly will interact, *e.g.* exchanging moisture, sugar, air, and temperature. If space could expand and carry, it has to interact.
- It is impossible to detect Doppler redshift ≥ 1 (light-speed Doppler redshift) in expanding space.
- It is impossible to detect inconsistent pulsation and Doppler effect in expanding space. Pulsation is also frequency, it has to be stretched or compressed precisely concise with Doppler effect. However, constant pulsating quasars with high redshift are observed. It proves that the redshift of quasar is not the Doppler effect.

I believe it is due to two overlooked presumptions:

1. 50:50 blueshift to redshift equal opportunity detection.
2. Redshift is the only result of Doppler effect.

The fact is Doppler redshift is dominating in nature, whether it is three dimensional space, area, or linear observation. Under the condition of no path attenuation and the observer has perfect vision in observation.

Electromagnetic radiations lose both amplitude and frequency over distance. High frequency can not travel as far. Top-end frequency would be lost first and the result is redshift detection by the observer. Due to the astronomic distance of celestial observation, it would easily overwhelm the Doppler effect and create an illusion of expanding space.

An observer is surrounded by celestial bodies. Space is filled with omnidirectional low frequency radiations from all bodies near and afar. The long-reach-able low frequencies can also come from beyond the visually observable universe. Nevertheless, cosmic background radiation is continuously created by the eternal activities of the universe,

not by a single event of big bang. Isn't it the same phenomenon of background noise created by all activities in and outside of a city?

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1 Introduction

Ever since Vesto Melvin Slipher had discovered 11 out of 15 spiral "nebulae" (Andromeda Galaxy) had redshifted spectral lines in 1912; and, the following redshift surveys have also shown the dominating and proportional detection of redshift. It has mushroomed into many ambiguous interpretations. Many pieces of puzzle just don't seem to fit. The main issue is, even all New Yorkers are moving out, it does not mean the city is getting bigger, unless all New Yorkers are anchored on the ground and moving apart. Nevertheless, no any object in the universe is anchored on the space. If detected redshift are interpreted as Doppler effect, and it is attributed to the space expansion, these assumptions ought to be true:

1. Space can expand and there is room for it to expand.
2. Space can expand faster than light-speed.
3. Space can carry, or it has friction to carry structure as large as galaxies.
4. Expanding space does not impose accelerating stress on riding structures.

However, space can only be regarded as infinite vacuum, or endless emptiness. Space is completely frictionless; It has no surface and can only be considered as absolute zero viscosity[4]. Not only space expansion is in question, but also it's capability of transport objects can not be proven. I believe none of the assumptions can be true, refer to Section 7.1.

Free-riding raisins are trapped in the dough. However, raisins might not go along with the expansion of runny batter, but certainly will interact, *e.g.* exchanging moisture, sugar, gas, and energy down to particle level. Both raisins and dough will also interact with the environment, *e.g.* dry up if baked or plum up if steamed. To expand, space has to be able to act by itself or react to the energy applied. To transport galaxies, space has to be able to impose friction; then there will be resistance; The complexity of space interactions is beyond logical comprehension, since space is inside and outside of atomic world. We have been manipulating matter and energy since our first existence on Earth, however, never space.

A galaxy is a collection of structures. It has to have inertia. It will react to acceleration of any kind, self-driven or free-ride. It operates under it's own intrinsic momentum of orbiting and rotating. If it was free-riding on expanding space, there would be accelerating and decelerating in different regions. Analogous to moving a gyroscope. It's structure will be under stress. Additional stress will be added if space accelerates. Even if the space could carry and tolerant unlimited acceleration, but not the galaxies, refer to Section 7.2.

Besides, expansion of the space contradicts to the redshifts observed.

- Since the distance to travel continue to increase in expanding space. It will delay the arrival of radiations, regardless of a galaxy is still, receding, or approaching. Delayed radiations will intensify redshift, however it is not Doppler effect, Section 7.3.

- Radiation will be forever trapped at first location where space is expanding at light-speed or faster. It will never arrive regardless when it is emitted, even long before the existence of the Earth. Hence, it is impossible to detect Doppler redshift ≥ 1 (light-speed Doppler redshift) in expanding space. In other words, detected redshift is not all Doppler effect of arrived radiations, certainly not the portion that is equal or greater than one ($z - 1 \geq 0$).

- In call cases, the detected redshift of arrived radiations does not tell the whole truth about the velocity of the source, not to mention the expansion of the Universe.

- Observed period of pulsating from quasar has to concur with Doppler redshift in expanding space, however, constant pulsating quasars are observed, Section 7.4.

I believe it has started with:

1. 50:50 redshift to blueshift linear assumption.

2. Proportional attenuation over distance (loss of amplitude, frequency, and quality due to, *e.g.* interference, resistance, or interaction of radiation with the environment en route).

Personally, equal opportunity assumption is rather discomforting. Since blueshift implies probability of collisions, and 50% is too high. We will often experience collisions in the universe. On the other hand, redshift has been interpreted as run-away universe, also made me blue. Many mind-bending questions can not be explained logically, Section 7.5.

Linear assumption is not applicable. The truth is, Doppler blueshift terminates and switches to redshift when the object passes the zero meridian of the observer. This nature of blueshift makes the redshift dominating even in linear observation. Under the conditions of no quality loss of radiation over distance, and the observer has perfect vision; The expected probability of Doppler redshift detection is greater than 92% in space.

Radiation redshift is not only the result of physical receding of the object, but also contingent upon the observation and the environment. It is the combined effect of,

1. increasing in distance (physical Doppler),
2. fixed point of reference can not be maintained by spiraling observer (observational Doppler, or camera effect), and
3. top-end frequency loss over distance (path attenuation or path loss).

Doppler effect can be redshift or blueshift, and it is bound by the physical limit of the object. On the other hand, path attenuation does not cause blueshift. It is limitless in it's rate of loss. It is very significant in signal transmission on Earth. There are many in-depth studies in many fields. Electromagnetic waves lose both amplitude and frequency over distance, and higher frequency can not travel as far as lower frequency. In summary:

- path attenuation does not cause blueshift (increasing in frequency),
- highest frequency will be lost first (redshift),
- it will last until all of it's intrinsic energy is absorbed,
- the energy of radiation can be fully absorbed by an obstacle in very short time, there is no limit of how fast the loss (or a very large z-value of redshift detection),
- there is cross interference en route, and
- over the distance, it will be exponentially proportional.

There is no Doppler effect if the distance of observation remains constant, however, path attenuation is unavoidable. I believe, the extent of attenuation over distance has been overlooked. Due to the astronomic distance of celestial observation, it overwhelms the Doppler effect and creates the illusion of expanding universe.

The object of this study is to exam the nature of redshift in visually comprehensive approach. Nonetheless, I do wish our message bottles (Pioneer and Voyager Sisters) and future of our children can go beyond, and certainly do not wish the universe to run away.

2 Creation of Doppler Effect

Even we might not be fully aware of Doppler effect in our daily life, it is everywhere in signal transmission over variable distance, *e.g.* sight and sound of moving object. Basically, any signal delivery in changing distance between the sender and the receiver. All creatures cope with Doppler effect. Ball player, predator and it's prey, mobile radio, etc. An excellent example is fishing osprey. It has to cope with the light going through water and air in high speed, under the condition of the environment, such as sunlight, wind, or even the noise from running boats and swimmers. Not only the location and motion but also the size of the fish, (or even selecting what kind of fish that only osprey knows). Ospreys don't have theory for Doppler effect but they are masters of coping with it.

The vast sky provides us the range of observation farther than we can reach. However, looking for blueshift in the sky is not as easy as we think. Blueshift can only be observed when the distance between the object and the observer is shrinking. Analogous to one can only go into the woods as deep as midpoint, then it is leaving; and there is no limit of leaving the woods. This terminate and switch over nature not only sets the limit of blueshift but also increases the chance of redshift detection.

2.1 Limited Range of Doppler Blueshift

The possible region of blueshift observation in three-dimensional space observation is depicted in Figure 1.

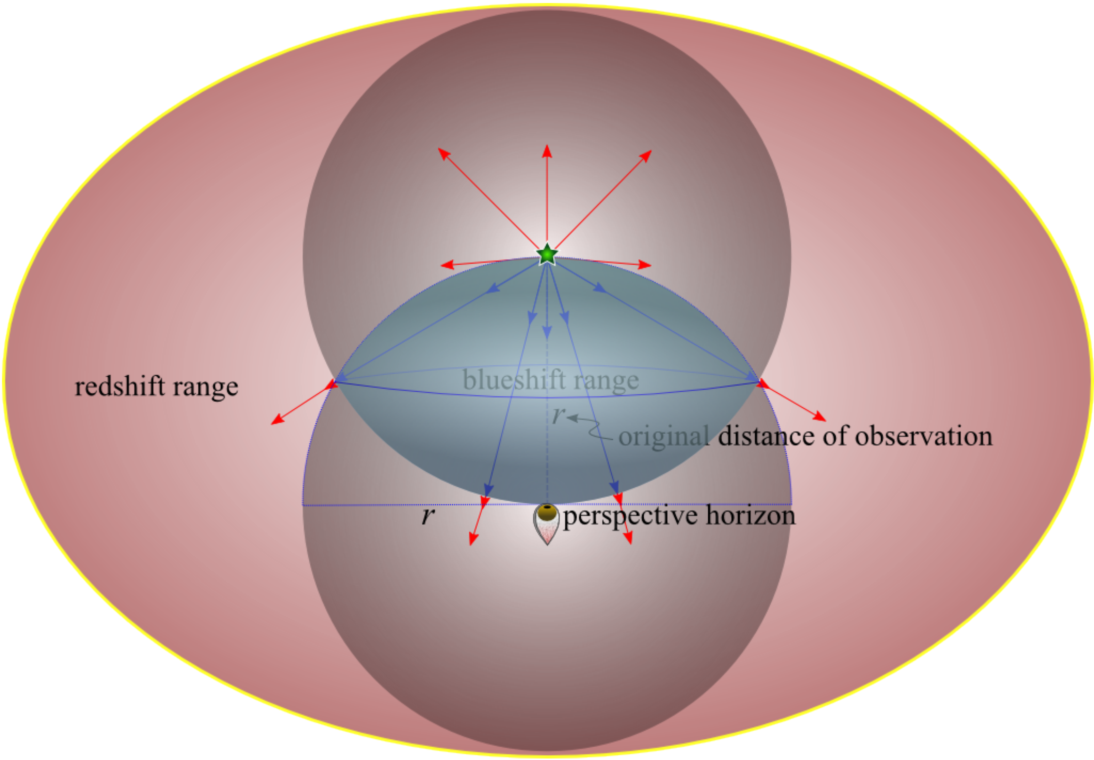

Figure 1: Limited Range of Blueshift Observation

Suppose an astronomical object (or source, show as green star), is r distance away from the observer (brown eye). If we picture two identical spheres with radius of r, one is centered at the observer, and another at the star. A disc shape of region is formed in the intersection of two spheres, shaded blue in Figure 1. Here, r is the original distance of observation, which is also the longest distance of blueshift observation. During the observation, for all the possible directions the star can go (in the perspective of the observer), blueshift can only be detected when it travels into and remains within the intersection, *i.e.* within the intersection, all subsequent distances of observation will not exceed the original.

The volume of the disc will shrink exponentially with the decreasing distance of the observation, however, it will stay the same shape as long as the distance of observation is decreasing. It will disappear when the star travels out of the intersection. In other words, unless the object collides with the observer, it will pass and redshift will be observed afterward. This means that blueshift observation has termination, and it will switch to redshift.

On the other hand, redshift will be detected in all directions outside of the blueshift range, and it can continue beyond the limit of the observation. It will never switch to blueshift unless the relative trajectory of the object is curved. Then, the object is not departing.

2.2 Mathematical Model of Blueshift Detection in Space

125 The total volume of the blueshift range is two equal size spherical caps, as shown in Figure 2.

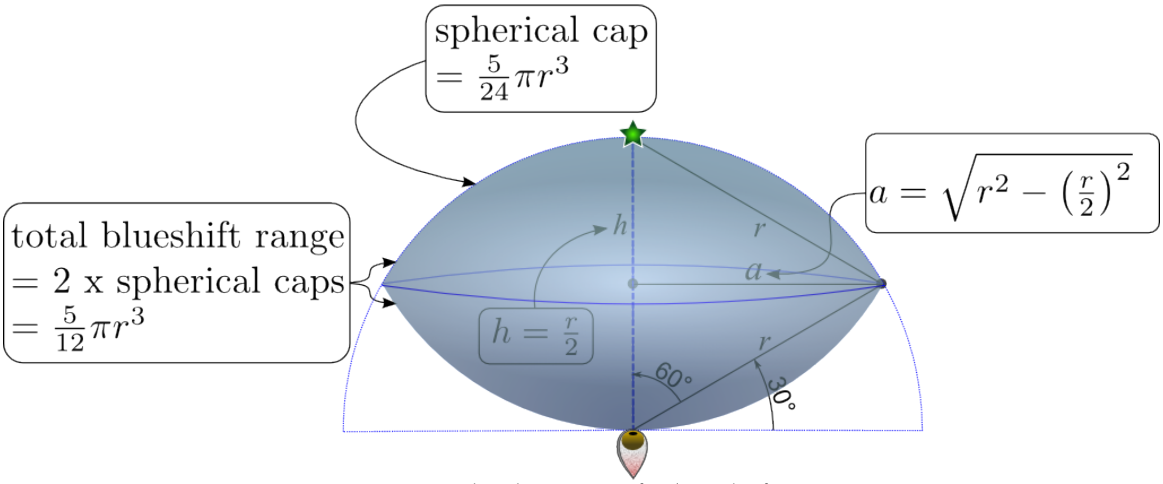

Figure 2: Calculations of Blueshift Range

Using the following formula to calculate the volume of the spherical cap:

$$\frac{\pi h}{6}(3a^2 + h^2)$$

$$\begin{aligned} \textit{height:of the cap (h)} &= \frac{r}{2} \\ \textit{radius of the base of the cap (a)} &= \sqrt{r^2 - \left(\frac{r}{2}\right)^2} \end{aligned}$$

Step by step calculations:

$$
\begin{aligned}
\frac{\pi h}{6}(3a^2+h^2) &= \frac{\pi\frac{r}{2}}{6}\left(3\left(\sqrt{r^2-\left(\frac{r}{2}\right)^2}\right)^2+\left(\frac{r}{2}\right)^2\right)\\
&= \frac{\pi r}{12}\left(3r^2-3\left(\frac{r}{2}\right)^2+\frac{r^2}{4}\right)\\
&= \frac{\pi r}{12}\left(\frac{12r^2}{4}-\frac{3r^2}{4}+\frac{r^2}{4}\right)\\
&= \frac{\pi r}{12}\left(\frac{10r^2}{4}\right)\\
&= \frac{10}{48}\pi r^3\\
&= \frac{5}{24}\pi r^3\\
\mathit{Alternatively,}&\\
h &= \frac{r}{2}\\
a &= \sin 60^\circ r = \frac{\sqrt{3}}{2}r\\
a^2 &= \frac{3}{4}r^2\\
\frac{\pi h}{6}(3a^2+h^2) &= \frac{\pi\frac{r}{2}}{6}\left(3\left(\frac{3}{4}r^2\right)+\left(\frac{r}{2}\right)^2\right)\\
&= \frac{\pi r}{12}\left(\frac{9r^2}{4}+\frac{r^2}{4}\right)\\
&= \frac{\pi r}{12}\left(\frac{10r^2}{4}\right)\\
&= \frac{10}{48}\pi r^3\\
&= \frac{5}{24}\pi r^3
\end{aligned}
$$

Hence, the total volume of the blueshift range is twice of the spherical cap:

$$2\left(\frac{5}{24}\pi r^3\right)=\frac{5}{12}\pi r^3$$

2.3 Probability Function of Blueshift Detection

There is limit of how far an observer can reach. It is considered identical in all directions of observation. Despite the observer is unlikely at the center of the universe, however, observation creates the illusion of centering observer. All data collected will be centered at the observer. As a result, an observer is always located at the center of the observable universe.

Suppose, on linear average, the object is expected to be located at halfway between the observer and the edge of the observable universe. Then, the distance from the observer to the edge of the observable universe (radius of the observable universe, or limit of observation) is $2r$, as the depicted in Figure 3.

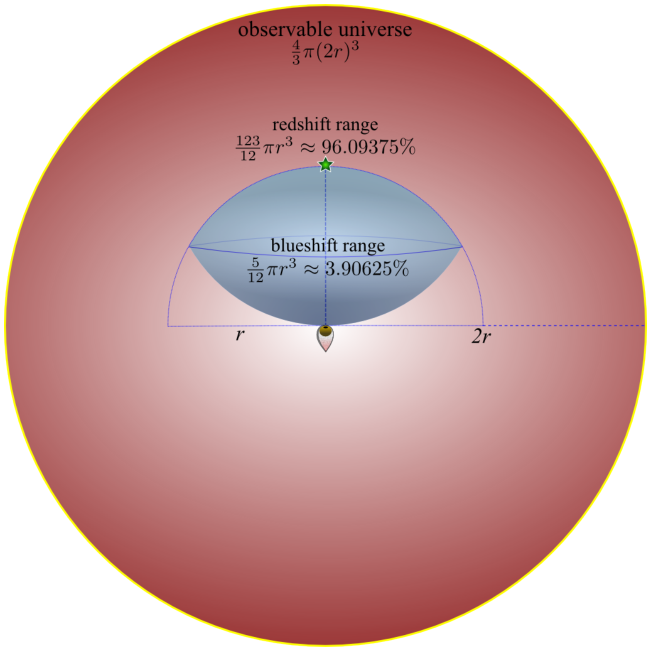

Figure 3: Linear Expected Probability of Blueshift Detection

Then, the size of the observable universe is $\frac{4}{3}\pi(2r)^3 = \frac{32}{3}\pi r^3$. Comparing the volume of the blueshift range to the total volume of the observable universe, we have:

$$\begin{aligned} &= \frac{5}{12}\pi r^3 \div \frac{32}{3}\pi r^3 \\ &= \frac{5}{128} \\ &= 3.90625\% \end{aligned}$$

This is the linear expected probability of blueshift will be detected, *i.e.* the object is expected to be halfway to the limit of the observation on average. Then, we can calculate the size of the redshift range,

$$\frac{32}{3}\pi r^3 - \frac{5}{12}\pi r^3 = \frac{123}{12}\pi r^3$$

and the linear expected probability of redshift detection,

$$\begin{aligned} &= \frac{123}{12}\pi r^3 \div \frac{32}{3}\pi r^3 3 \\ &= 1 - \frac{5}{128} \\ &= \frac{123}{128} \\ &= 96.09375\% \end{aligned}$$

Standardized the equation by setting the radius of the observable universe (or limit of the observation) to one, then the total volume of observable universe is $\frac{4}{3}\pi$. The probability function of the blueshift detection for any object at the location (r) within the limit of observation [0, 1] can be obtained with the following probability density function:

$$\begin{aligned} p(r) &= \frac{5}{12}\pi r^3 \div \frac{4}{3}\pi \\ &= \frac{5}{16}r^3 = 0.3125r^3 \\ & \quad where\ (0 \leq r \leq 1) \end{aligned}$$

Here r is the ratio of the distance of observation and the limit of observation:

$$r = \frac{distance\ of\ observation}{limit\ of\ observation}$$

With this standardized probability function, we can calculate the probability of blueshift and redshift detection per distance. For example: if we can detect the Doppler effect up to 20 billion light years (bly), and like to know the probability of blueshift detection of an object located at 4 bly away. Then from the equation $p(r) = \frac{5}{16}r^3$, we have:

$$\begin{aligned} p\left(\frac{4}{20}\right) &= \frac{5}{16}\left(\frac{4}{20}\right)^3 \\ &= 0.0025 = 0.25\% \end{aligned}$$

And the probability of redshift detection is:

$$q\left(\frac{4}{20}\right) = 1 - p\left(\frac{4}{20}\right) = 99.75\%$$

2.4 Probability Distribution of Blueshift Detection

The probability distribution of Doppler blueshift detection in space is shown in Figure 4.

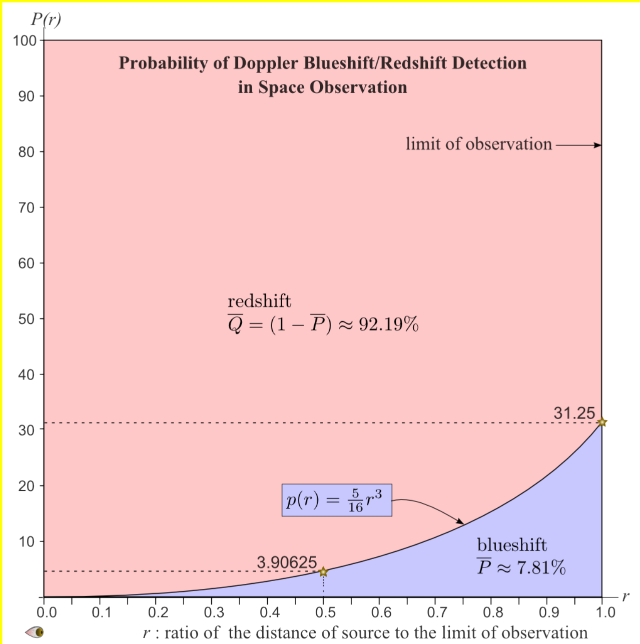

Figure 4: Probability Distribution of Blueshift Detection in Space

From Figure 4, we can see the probability of blueshift detection is within the range of [0, 31.25]%, and the majority is located from father than half of the observable universe; and redshift within the range of [68.75, 100]%. And we have the weighted population mean of blueshift detection:

$$\int_0^1 \frac{5}{16} r^3 \mathrm{d}r$$

Computing the integral of probability function yields the expected population mean of blueshift detection, $\overline{P}$:

$$\overline{P} = \sum_{r=0}^{1} \frac{5}{16} r^3 \Delta r \approx 7.81\%$$

And the expected population mean of redshift detection: $\overline{Q}$:

$$\overline{Q} = 1 - \overline{P} \approx 92.19\%.$$

A table of accumulated probability distribution of blueshift detection is listed in Section 7.7. Referring to the table, we can calculate the probability of blueshift detection within a range of observation.

For example, the expected Doppler detection of objects located in near half of the observable universe:

$$\begin{aligned} blueshift: P(r \leq 0.5) &= 0.48867201\%, \\ redshift: Q(r \leq 0.5) &= 1 - P(r \leq 0.5) \\ &= 99.51132799\%. \end{aligned}$$

And, the expected probability of Doppler detection of objects located in far half of the observable universe:

$$\begin{aligned} blueshift: P(0.5 \leq r \leq 1) &= P(r \leq 1) - P(r \leq 0.5) \\ &= (7.81406258 - 0.48867201)\% \\ &= 7.32539057\%, \\ redshift: P(0.5 \leq r \leq 1) &= 1 - 7.32539057\% \\ &= 92.67460943\%. \end{aligned}$$

2.5 Underlying Conditions

The function obtained here is the probability of a object coming toward (blueshift) or moving away (redshift) from the observer's prospective, *i.e.* the physical displacement of the object in reference to the observer. The information obtained from the observation is centered at the observer.

It is assumed that the distance of observation is always changing, due to the spiral trajectory of observer gives very little chance of fixed distance of observation, and next to zero in long run. That is, only blueshift or redshift will be detected.
Above all, it is under the conditions that,

- there is no attenuation of radiation over distance,
- observer remains fixed (or the action of the observer does not alter the information obtained from the observation), and
- the observer has perfect vision,

however, none of which is true in real world.

2.6 Cross-Check with Redshift Survey

Let's do a quick cross check with NASA/IPAC Extragalactic Database (NED).

Objects found in NED's list, November 2, 2014		
redshift objects ($z > 0$)	5,166,694	1.097%
blueshift objects ($z < 0$)	9,334	0.002%
marginal objects ($z = 0$)	2,939	0.001%
Total objects with redshifts	5,178,967	1.100%
Total objects without redshifts	465,814,004	98.900%
Total objects found	470,992,971	100.000%

Table 1: NASA/IPAC Extragalactic Database (NED)

If we only compare the objects with redshifts:

Objects with redshifts		
redshift objects ($z > 0$)	5,166,694	99.763%
blueshift objects ($z < 0$)	9,334	0.180%
marginal objects ($z = 0$)	2,939	0.057%
Total objects with redshifts	5,178,967	100.000%

Table 2: Redshift Objects (NED)

The spiral trajectory of observer gives very little change of fixed distance of observation, and next to zero in long run. The 2,939 ($z = 0$) objects are assumed marginal, and it will become clear in follow-up observation. The possibility can be one of the these:

1. Passing-by blueshifted objects (incoming object near the zero meridian, or perihelion, from the observe). They will show redshift in follow-up observation.

2. Redshifted objects at returning orbit (departing object at the far-end zero meridian, or aphelion, from the observe). They will show blueshift when curve back to an adequate distance in follow-up observation.

3. Inadequate detection by various causes.

However, it is expected that 92.19% of these 2,939 objects will shown redshift ($z > 0$) in follow-up observations. Despite the objects with redshifts is only a very small portion of the total objects found, the high count of redshift ($z > 0$) comparing to blueshift ($z < 0$) confirms the dominating nature of redshift.

Noted that Doppler effect is depending on the velocity not the location of the object, detected Doppler redshifts do not have to be proportional to the distance. However, NED's observation shows the positively proportional distribution of redshifts. It suggests something else more than just Doppler effect.

The very large objects without redshift, 465,814,004, is assumed inadequate detection. The distance of celestial observation can only be considered changing constantly. There will always be Doppler effect ($z \neq 0$) despite it can be beyond detection. Inadequate detection can be the result of interference of the environment and the capability of our technology of detection. Even if we ignore this very high portion (98.9%) of objects without redshifts, but, it is also expected that 92.19% of them will have ($z > 0$) when it can be obtained.

On the other hand, only 1.1% of objects with redshifts are detected, I doubt that we have sufficient information of hastening the fate of the universe and it's past.

2.7 Probability Function in Surface Observation

In a two dimensional surface case, the area of the blueshift range is shown in Figure 5.

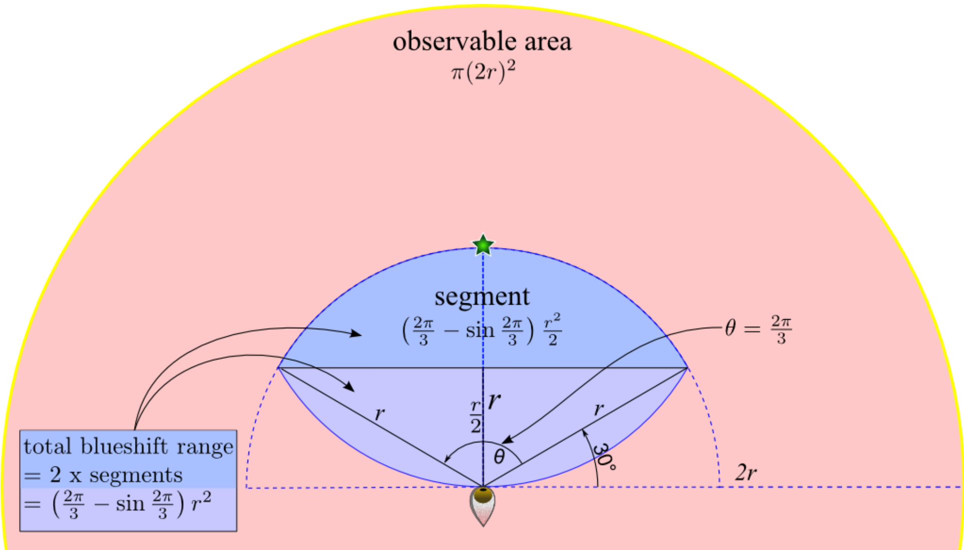

Figure 5: Calculations of Blueshift Range in Surface Observation

From the formula of calculating the area of segment:

$$\left(\frac{2\pi}{3} - \sin\frac{2\pi}{3}\right)\frac{r^2}{2}$$

and the blueshift range is twice,

$$\left(\frac{2\pi}{3} - \sin\frac{2\pi}{3}\right) r^2$$

Standardize the equation by setting the radius of the observable area to one, the total observable area becomes (π). The probability of the blueshift detection for any object at the location (r) can be obtained with the following probability density function:

$$\begin{aligned} p(r) &= \left(\frac{2\pi}{3} - \sin\frac{2\pi}{3}\right)\frac{r^2}{\pi} \\ &= \left(\frac{2\pi}{3} - \frac{\sqrt{3}}{2}\right)\frac{r^2}{\pi} \\ &= \left(\frac{2}{3} - \frac{\sqrt{3}}{2\pi}\right) r^2 \\ &\approx 0.391 r^2 \\ & \quad \textit{where } (0 \le r \le 1) \end{aligned}$$

The probability distribution of blueshift observation on surface is shown in Figure 6.

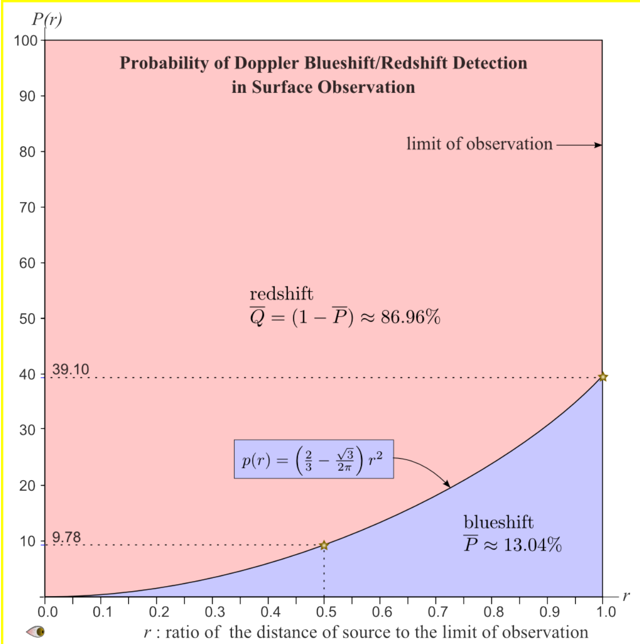

Figure 6: Probability Distribution of Blueshift Detection in Surface Observation

The population mean of blueshift detection in surface observation:

$$\int_0^1 \left(\frac{2}{3} - \frac{\sqrt{3}}{2\pi}\right) r^2 \mathrm{d}r$$

Computing the integral yields the expected population mean of blueshift detection, $\overline{P}$:

$$\overline{P} = \sum_{r=0}^{1} \left(\frac{2}{3} - \frac{\sqrt{3}}{2\pi}\right) r^2 \Delta r \approx 13.04\%$$

And the expected population mean of redshift detection $\overline{Q}$:

$$\overline{Q} = (1 - \overline{P}) \approx 86.96\%$$

Here we can see the minimum probability of blueshift is 0.0%, and the maximum 39.1% of observable area; and redshift is in the range of [60.9, 100]%.

2.8 Probability Function in Linear Observation

The assumption of 50:50 redshift to blueshift posts a problem even in linear observation. Let say all objects in west (left) side of an observer has equal chance to go eastward or westward in linear path. The westward action will go left toward the west limit of observation. The eastward action will go right, pass the observer, and continue to the east limit of observation as depicted in Figure 7.

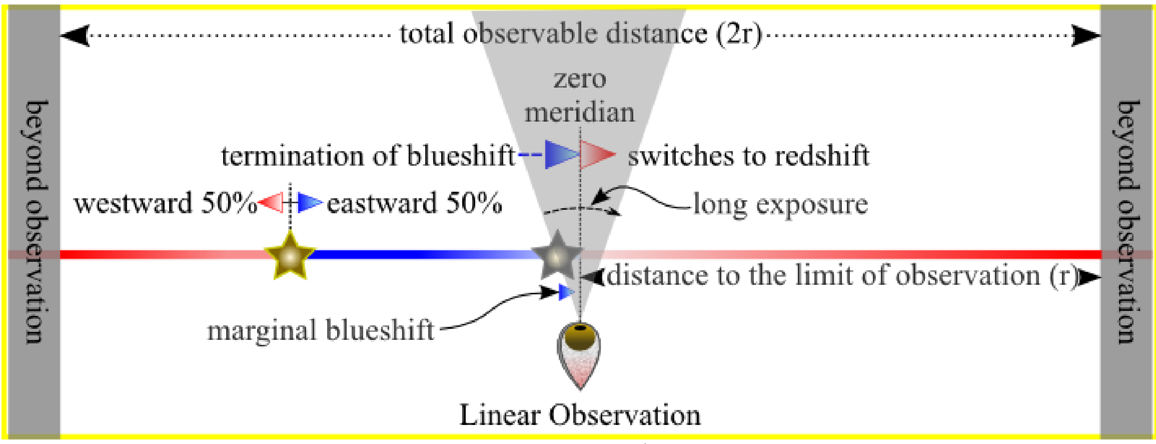

Figure 7: Linear Observation

The westbound action shows all redshift through out. However, the eastbound action shows blueshift for a duration, then switches to redshift. In long term, the observer will have chance of 1:2 blueshift to redshift, or possible $\frac{1}{3}$ of blueshift observation simply by count.

However, Doppler effect is not a simple survey of counting redcoats or bluecoats. It requires duration of observation to identify whether it is blue or red. The issue is blueshift deserts when crosses the zero meridian. Particularly in long tracking observation, *i.e.* when the object is kept at a fixed location in viewing frame for long duration of observation (long exposure and multiple exposures[1], shown as gray triangle in Figure 7), marginal blueshift radiation from eastbound object near the zero meridian (shown as gray star in Figure 7) can be washed or overridden by the subsequent redshift recorded in the same frame of exposure. Hence, the probability of blueshift observation can only be lower, when it is based on the duration of observation (exposure), as the same method used in surface and space observation earlier.

[1]The Hubble Ultra Deep Field snapped 800 exposures, two exposures per orbit, averaged 21 minutes per exposure. It amounted to about 1 million seconds or 11.3 days of viewing time. The exposures were taken over four months, from Sept. 24, 2003 to Jan. 16, 2004, Hubble's Deepest View Ever.[5]

Since blueshift terminates at zero meridian, the blueshift duration is $[0, r]$, hence the average blueshift observation is $\frac{r}{2}$ based on the total observable distance of $2r$. Which means the average probability of blueshift detection is 25% ($\frac{r}{2} \div 2r$). When standardized, the probability of the blueshift detection for any object at the location (r) can be obtained with the following probability density function:

$$p(r) = \frac{r}{2}, \; where \; (0 \leq r \leq 1)$$

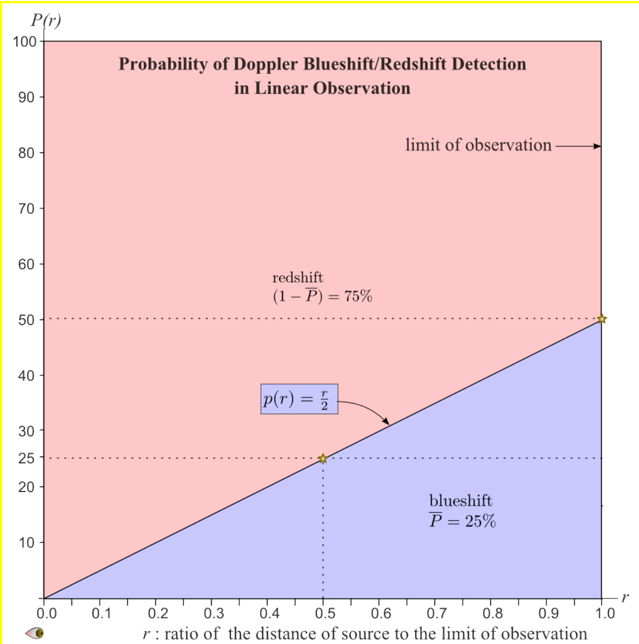

Figure 8: Probability Distribution of Blueshift Detection in Linear Observation

Figure 8 shows the expected population mean of blueshift detection in linear observation, $\overline{P}$ = 25%, with the minimum of 0% and maximum of 50%. And, redshift detection $(1 - \overline{P})$ = 75% within the range of [50, 100]%. Redshift remains dominating, even in linear observation. The 50:50 presumption is invalid in an observation when sample can switch it's attributes, blueshift switching to redshift in this case.

2.9 Probability Function Comparison

Probability of Doppler Blueshift Detection at Location r, $(0 \le r \le 1)$

Blueshift Detection	Probability Function $p(r)$	Population Mean (%)	Mode (%)	Range (%)
Space	$\frac{5}{16}r^3$	7.81	31.25	0.00 – 31.25
Surface	$\left(\frac{2\pi}{3} - \frac{\sqrt{3}}{2}\right)\frac{r^2}{\pi}$	13.04	39.10	0.00 – 39.10
Linear	$\frac{r}{2}$	25.00	50.00	0.00 – 50.00

Table 3: Blueshift Probability Functions

Probability of Doppler Redshift Detection at location r, $(0 \le r \le 1)$

Redshift Detection	Probability Function $1 - p(r)$	Population Mean (%)	Mode (%)	Range (%)
Space	$1 - \frac{5}{16}r^3$	92.19	100	68.75 – 100
Surface	$1 - \left(\frac{2\pi}{3} - \frac{\sqrt{3}}{2}\right)\frac{r^2}{\pi}$	86.96	100	60.90 – 100
Linear	$1 - \frac{r}{2}$	75.00	100	50.00 – 100

Table 4: Redshift Probability Functions

$$r = \frac{\textit{distance of observation}}{\textit{limit of observation}} = \frac{\textit{distance of object}}{\textit{observable universe}}$$

2.10 Properties of Doppler Effect

Let's take a closer look of simplified version to exam the properties of Doppler effect. First, I assume:

- The object travels straight line (in the perceptive of the observer).
- The velocity of the object remains constant.
- There is no quality loss of the radiations.
- The observer has perfect vision.
- All other conditions remain fixed.

2.10.1 Properties of Doppler Blueshift

Suppose an object is approaching in straight line from the left side of an observer. The decreasing in distance of observation is shown as blue line. The Doppler blueshift is proportional over distance, however, inversely, as depicted in Figure 9.

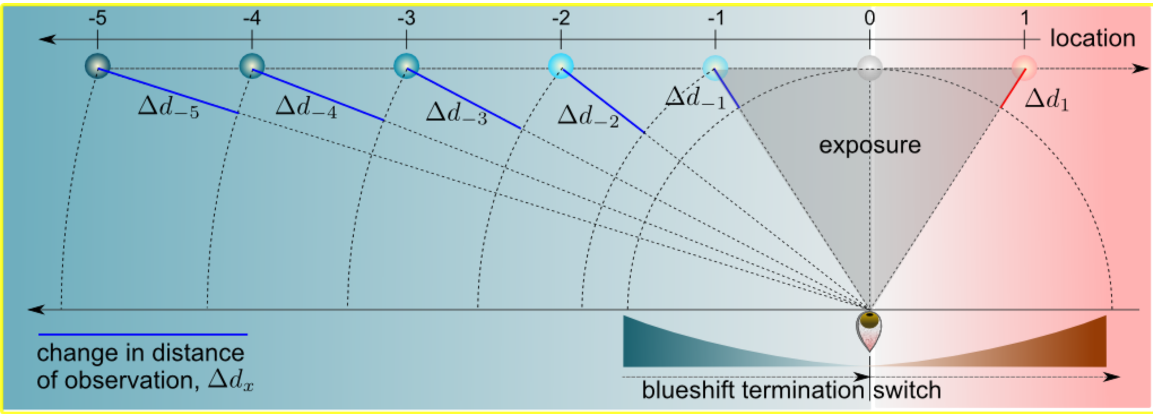

Figure 9: Blueshift Deceleration of Linear Trajectory

For example, if an object is located at -5, and move to -4 within the period of observation (exposure), the change in distance of observation is Δd_{-5}, shown as solid blue line in Figure 9. If the same object is located at -4, and move to -3, the change in distance of observation is Δd_{-4}. It has smaller change in distance of observation (wavelength is less compressed), hence the lower blueshift will be detected.

This is also true with the length of exposure, the longer the exposure the closer the object will be, and smaller blueshift detection. For example, the exposure lasts from -1 to 0 will detect blueshift. However, the exposure lasts from -1 to 1 may not. The further the object, the longer exposure is needed, hence the smaller blueshift detection.

And, it remains true in the case when snap shots are taken at different time. For example, the snap shot at location -5 to -4 will detect blueshift. However, the snap shot at location 0 to 1 in later observation will detect redshift.

Blueshift will terminate and switch to redshift at zero meridian. It will be washed, cancelled, or overridden by the subsequent redshift recorded in the same frame. For example, if exposure starts at location -1 and lasts till 1 (gray shaded triangle in Figure 9), the decreased distance, Δd_{-1} and increased distance, Δd_1 will offset each other in the same frame of observation. Observation of this kind will not be able to detect the Doppler effect correctly. It will reduce the chance of blueshift observation.

In three-dimensional observation, blueshift will raise and fall within the blueshift range (increase and decrease of viewing angle), except the collision course. It accelerates in first part of the trajectory until the zero meridian of the observer, it then decelerates. It switches to redshift when it is out of the blueshift range, *i.e.* distances of observation has exceeded the original, as depicted in Figure 10.

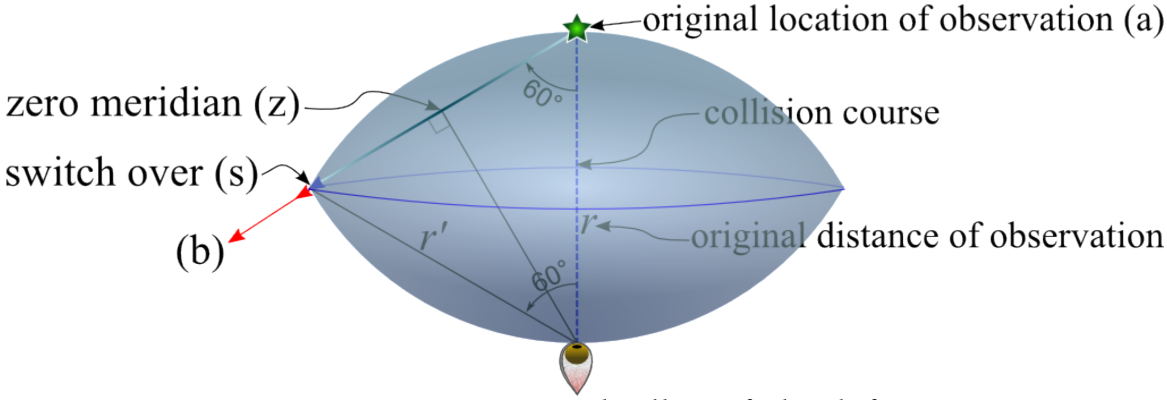

Figure 10: Raising and Falling of Blueshift

For example, if the star at the original location (a) travels the 60° direction toward (b). Blueshift will be raising from (a) till zero meridian (z) at peak, and then falling until switch over location (s). It switches to redshift when it is out of range. The raising and falling will counteract:

- Blueshift intensifies when the exposure lasts less than [a, z].
- It fades when the exposure is longer than [a, z].

- It will be overridden by redshifted if the exposure is longer than [a, s].

Certainly, this case may not be practical in celestial observation to have such a long exposure. Figure 10 is a enlarged version of showing the raising and falling nature of blueshift. However, it is possible in the snap-shot observation over long period discussed early. It can also happen when the star travels close to 90° direction (marginal blueshift range), as depicted in Figure 11.

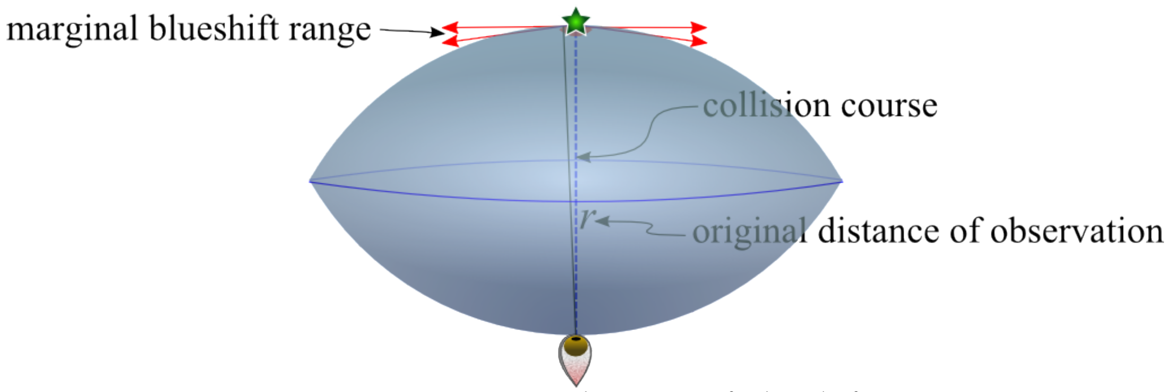

Figure 11: Marginal Region of Blueshift

Which means blueshift can disappear during the observation, it lessens the probability of blueshift detection. The point here is blueshift can be dimmed by multiple exposure, long exposure, and/or changing reference (moving observer) of observation. Since distance object requires long exposure, it is harder to detect blueshifted object located afar.

Here is a summary of properties of Doppler blueshift in linear trajectory:

1. Probability of blueshift detection is dim, $\approx 7.81\%$ in space, $\approx 13.04\%$ in area, and 25% in linear observation, Section 2.9
2. Population mode is located at the limit of detection. Majority of blueshift has to travel long distance. Which makes it vulnerable to environment.
3. Blueshift moves toward higher frequency range, which can not travel as far. It shortens the observational reach.
4. Long exposure of distance object weakens blueshift, it is more likely be detected in closer range and/or high intensity.
5. It is terminal, it can not exceed the original distance of observation.
6. It switches to redshift, each coming object will be leaving except collision.

In non-linear trajectory, Doppler blueshift will cycle with redshift, the magnitude of blueshift will vary with the trajectory. Unless there is collision with the observer, it will pass the near side of zero meridian, aphelion, and depart.

Nevertheless, blueshift is not an indication of contraction of space in any case. The motion of objects is an event, and the contraction or expansion of it's play field is another; Even if the objects are affixed on the field, motion of objects can not be used to describe the size change of it's play field.

2.10.2 Properties of Doppler Redshift

On the other hand, redshift is positively proportional over distance. Through out the observation, the viewing angle refereed to the zenith increases (decreases in reference to the horizon). The increasing in distance of observation is shown as red line. Doppler redshift will accelerate as depicted in Figure 12.

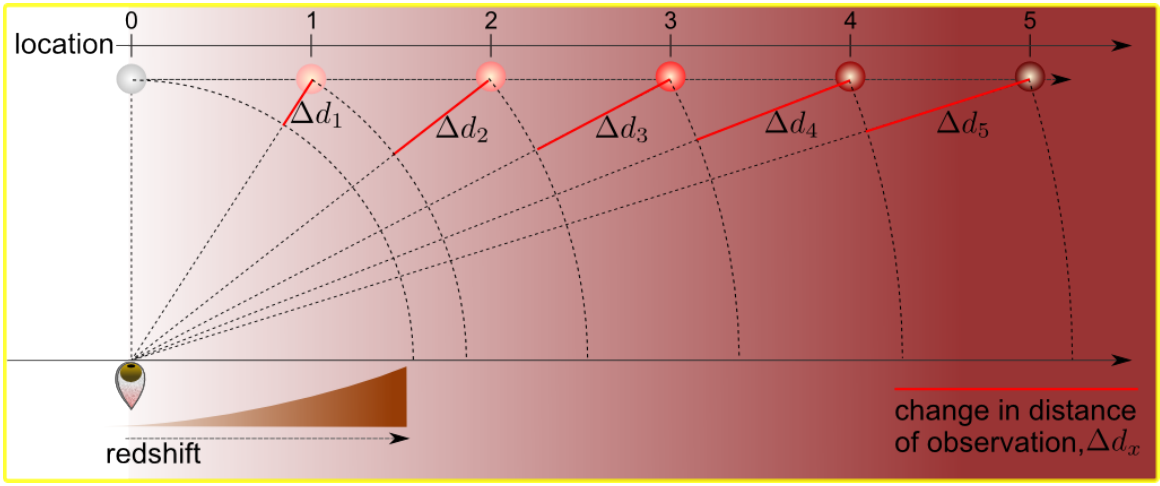

Figure 12: Redshift Acceleration of Linear Trajectory

For example, if an object is located at 0, and move to 1 within the period of observation, the change in distance of observation is Δd_1, shown as solid red line in Figure 12. If the same object is located at 1, and move to 2, the change in distance of observation is Δd_2, it has larger change in distance of observation per same duration of exposure, wavelength is further stretchered, hence the higher redshift (and weaker radiation) will be detected. The same phenomenon applies to other location, 2, 3, and so forth.

This is also true with the length of exposure, the longer the exposure the larger redshift will be detected. For example, the exposure lasts from 0 to 2 will detect the higher redshift than exposure lasts from 0 to 1. And the further the object, the longer the exposure is needed, hence the larger redshift.

And, it remains true in the case when snap shots are taken at different time. For example, the snap shot taken at location 4 to 5 will detect higher redshift than at location 0 to 1 in earlier observation.

Here is a summary of properties of Doppler redshift in linear trajectory:

1. Probability of redshift detection is dominating, $\approx 92.19\%$ in space, $\approx 86.96\%$ in area, and 75% in linear observation (refer to Section 2.9).

2. Population mode is located at the vicinity of the observer. Majority of redshift only travels short distance. Which makes it less vulnerable to environment.
3. Redshift moves toward lower frequency range, which can travel further then blueshift. It has longer range of observation.
4. Long exposure of distance object strengthens redshift, it makes redshift easier to detect over distance.
5. Redshift will continue without limit.
6. It remains redshifted, never pass the zero meridian of observation.

In non-linear trajectory, the magnitude of Doppler redshift will also vary with the trajectory. It can pass the far side of zero meridian (aphelion) and turn blueshift. In this case, the object will return, then it is not an indication of departing object.

When an object is approaching it's aphelion, redshift will start to fade in accelerating rate (marginal redshift). It will be out of sight when it is out of the detecting range of the observer. Nonetheless, it does not mean the object will not return. On the opposite end, blueshifted object will not disappear from view. Marginal blueshift will show the switch-over, however, blueshift detection is rare and harder to detect afar.

Considering the galactic period of the Sun can be 250 million years. The long span of orbiting cycle of celestial body makes it extremely difficult for short-lived observers to detect the fading and switchover. I doubt that we have detected the cosmic Doppler long enough to hasten the fate of the universe and it's past. Nevertheless, Doppler redshift detection will remain dominating.

3 Observer and the Environment

Radiation redshift is not only the result of Doppler effect caused by physical displacement of the object. It is also contingent upon the observer and the environment.

Earthling observers are riding on the spiral trajectory of Earth, Solar System, Milky Way and beyond. Changing in viewing angle of the observer is involuntary. The trajectory and velocity of the observer will create camera effect of observation.

Frequency drift is unavoidable in all types of waves. Analogously, musical instruments sound differently in variation of the environment, *e.g.* humidity, air mixtures, temperature, pressure, etc.

3.1 Doppler Effect of Rotating Observer

An observer on the Equator will have different distance of observation of the Sun. It is furthest at sunrise and sunset, and closest at noon. A rough distance calculation of the observer to the surface of the Sun is shown in Figure 13.

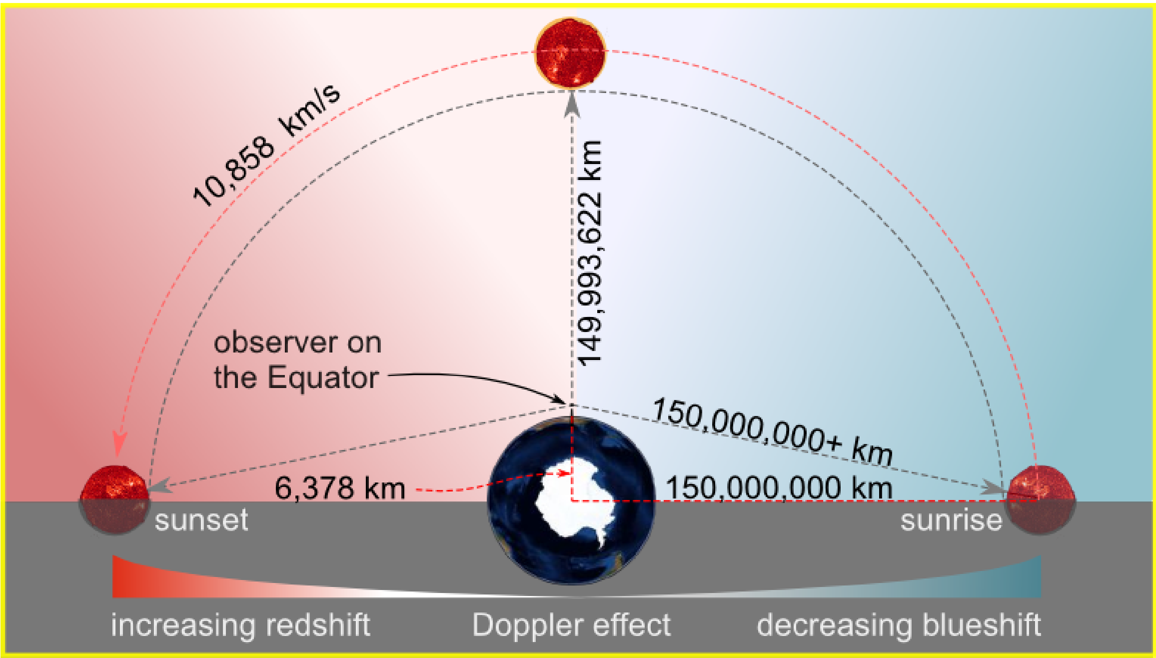

Figure 13: Rotational Doppler Effect

The distance of observation varies from over 150,000,000 km at sunrise and sunset to 149,993,622 km at noon. The wave-length shortens from sunrise to noon, and lengthen from noon to sunset. Blueshift would peak by sunrise, and redshift by sunset. It will be a little harder to detect blueshift since it is in the diminishing cycle and it will switch to redshift when the Sun passes the zenith.

Doppler cycle shown here is not center-to-center reference, but the observer to the surface of the Sun. It is only a simplified version of Doppler effect caused by the rotation of off-center observer. It reminds me of riding on merry-go-round. Rotating view and motion are both exciting. However, it is not easy to maintain a fixed view on object not on the merry-go-round. And, the voices of people on the ground sound funny. The effect will be captured on the same view frame in long tracking exposure of observation. It might not be measurable for celestial observation, but the concept of Doppler effect caused by the moving observer is the same.

Observation is personal, similar to viewing rainbow, none will see the same rainbow, and an observer will not see the same rainbow in different time. I am sure of the Doppler effect observed at the center of Milky Way will not be the same, however, it is impossible to figure the extent of discrepancy, unless we have the relative trajectory and velocity.

The point here is, detected Doppler effect contains the orbital and rotational variations of Earthling observer riding on the trajectories of Solar System, Milky Way and beyond (local galactic group, cluster, etc.). Similar to moving camera effect used by movie industry. It is positively proportional to the exposure. It is also observer dependent. It doe not fully represent the true physical center-to-center reference of the Earth, Sun, or Milky Way and the object.

3.2 Environment Conditions

We all see the color of sunrise and sunset. Radiations form the Sun is influenced by the atmosphere, and likely charge particles and magnetic field of the Earth as well. It does not cause blueshift, nor does it go away. It is not the physical motion of the object, but the environmental conditions, as depicted in Figure 14.

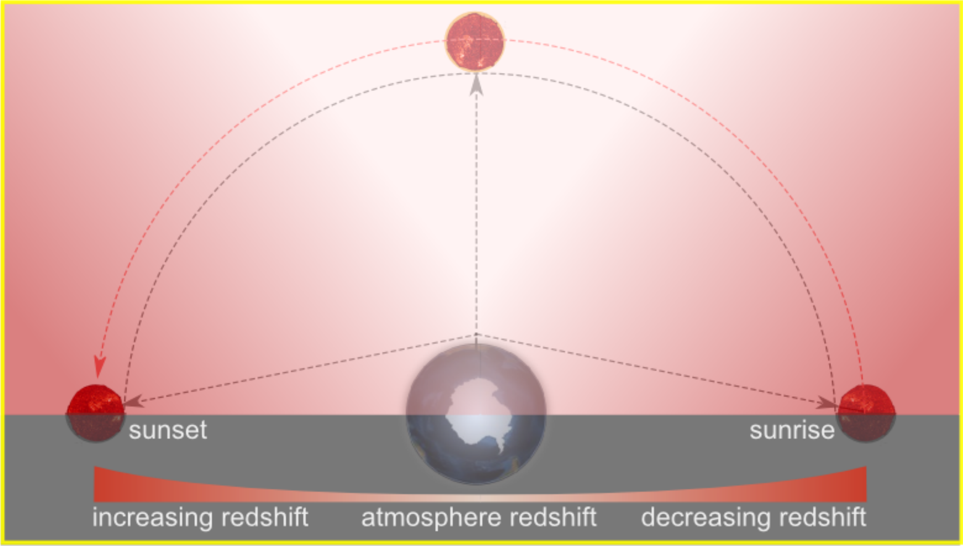

Figure 14: Sunlight Redshifted by Atmosphere

If we put together Figure 13 and Figure 14, it might look like Figure 15.

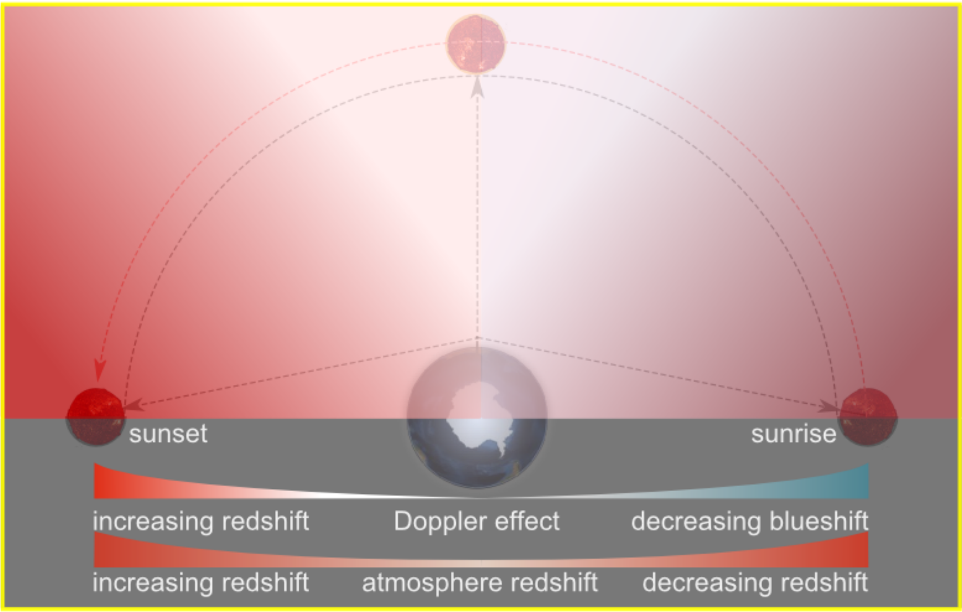

Figure 15: Combined Effect of Doppler and Atmosphere of the Sun

Figure 16 is the actual photos from sunrise to sunset (from right to left).

Figure 16: Sunrise to Sunset (right to left)
Image credit at lower left corners

I don't think anyone has trouble seeing the redshift of the sunlight caused by the environment, however, it will take sufficient technology to detect the Doppler effect. The point is, any obstacle can delay and alter the radiations. I believe it has to apply to night observation of rising and setting of objects in sky, *e.g.* stars and galaxies.

3.3 Heliosphere of The Solar System

Here is the magnetic bubbles outside of Solar System, discovered by Voyager at Solar System's Edge[2], Figure 17.

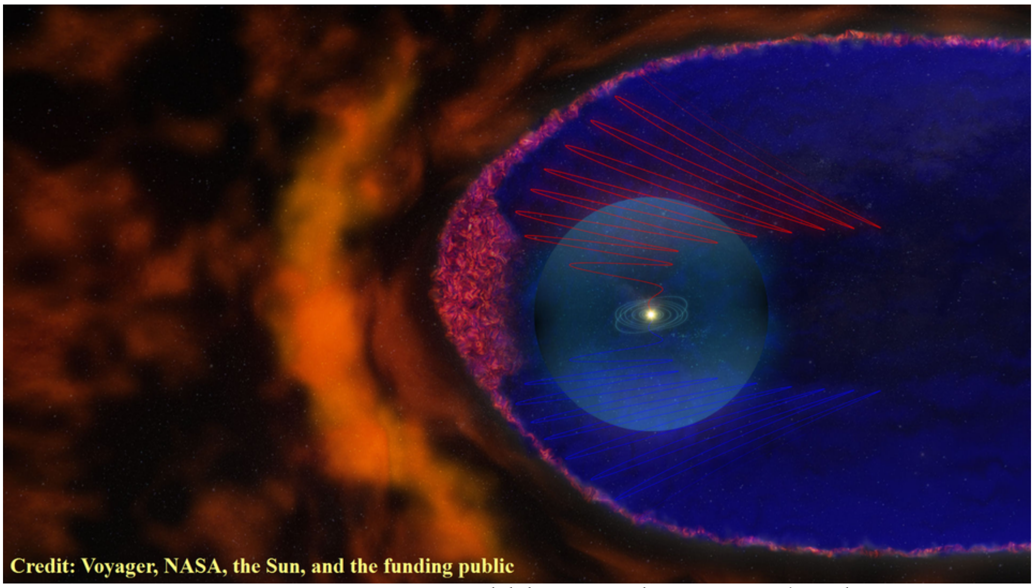

Figure 17: Magnetic Bubbles at Solar System's Edge

Can we assume the electromagnetic radiations from space will arrive without quality loss, *i.e.* loss of amplitude and frequency, delayed, or tinted?

3.4 Cross Radiations in Space

Coming from vast number of sources in all directions, cross radiations will fill the sky from all locations. A simplified illustration is depicted in Figure 18.

[2]NASA: A Big Surprise from the Edge of the Solar System.[5]

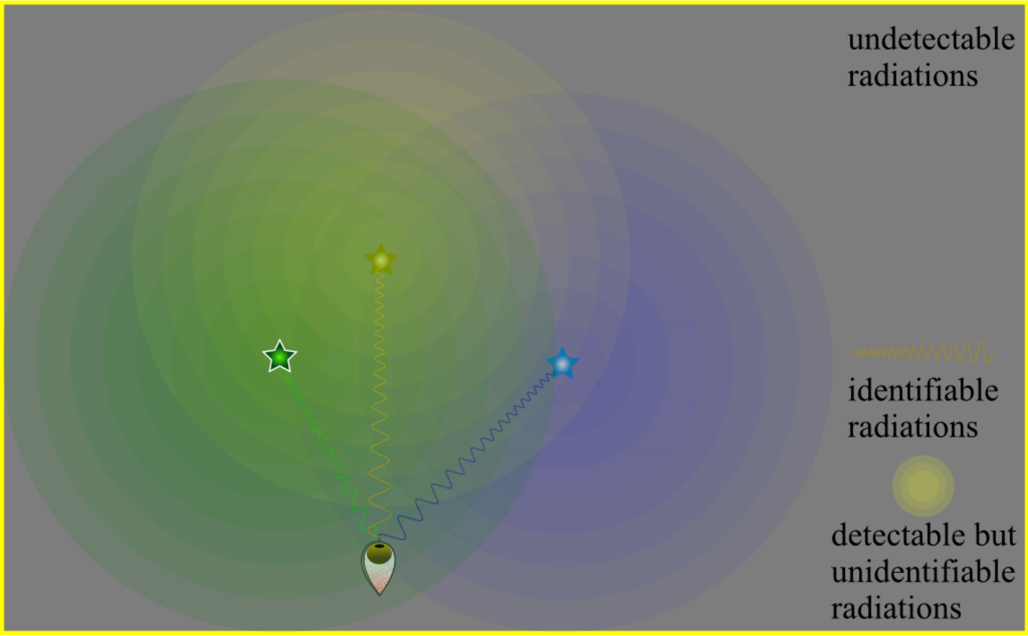

Figure 18: Cross Radiations

Any object in the sky emits radiations. However, not all radiations are detectable (gray area in Figure 18), and not all detectable radiations are identifiable by our instruments. The source can be identified when we can detect the concentric part of the radiations, where the radiations from the source are most concentrated in direct line of sight. Other propagated or interferences of radiations can be beyond detection, or only be detected as background by us, as depicted in Figure 19.

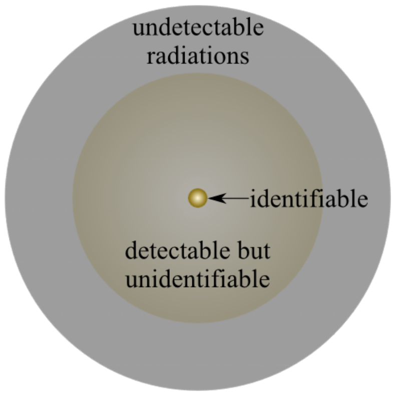

Figure 19: Concentric Radiations

3.5 Sky In A Box

John Tyndall's[8] sky in a box[3] clearly demonstrates the frequency loss as well as amplitude loss over distance in the visible region of electromagnetic spectrum. It is further validated the loss is exponentially proportional over the distance by John Strutt in Rayleigh scattering[7]. Here is s screen shot of BBC's Science Britannica - Clear Blue Skies hosted by Prof. Brian Cox, Figure 20. We can see the high frequency (blue light) is lost first, and low frequency (orange) passes through. It will be color red at the end if the glass box is longer, as Prof. Brian Cox explained in the video.

[3]BBC Science Britannica - Clear Blue Skies,hosted by Prof. Brian Cox.[1]

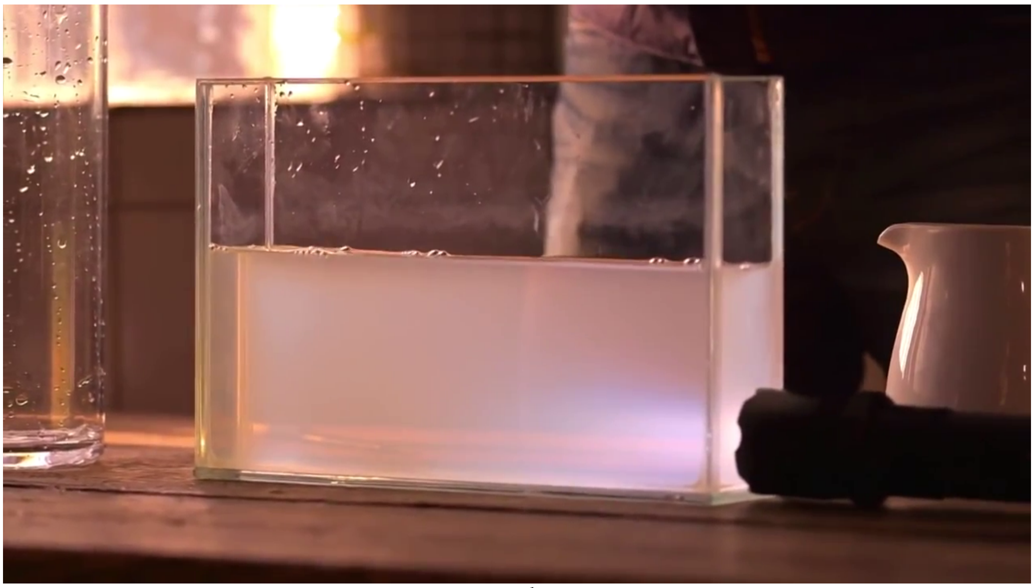

Figure 20: Sky in a Box
BBC Science Britannica- Clear Blue Skies

Cosmic Background Radiation (CBR) is estimated to be 2.7 °K (-270.5 °C, or -454.8 °F). Since it is not absolute zero, it means there are activities in all regions of space. Nevertheless, passing-through radiations will not move in complete freedom without interactions. There is interference everywhere, hence, attenuation of radiation can not be avoided. The accumulated interference can only be exponentially proportional to the distance.

4 Lost in Translation

Physical events in the universe broadcast information in many forms. Since we are observing the electromagnetic radiations, it is similar to watching TV broadcasting from space. Despite it evades the approval from FCC, it can no get away from the laws of physics. Radiations from space have to suffer the same path attenuation (path loss). The received radiations will not concur with the transmission. We know there are loss of aptitude as well as frequency over distance, and quality loss by interferences of the environment. We also know low frequency has longer reach than high frequency with given energy. The top-end frequency will be lost first and continue on. Lost of top-end frequency will create the redshift to the observer. Even if the distance of observation remains unchanged (no Doppler effect), there always be frequency loss. It is also proportional to the distance exponentially.

TV viewers demand high-def, but astronomers are easily excited with just few dots on the screen from celestial broadcastings. It is considered to be adequate, as along as the radiations can be detected. The issue of redshift is not emphasized on amplitude but frequency loss in higher spectrum of the radiations, a simplified depiction is show in Figure 21.

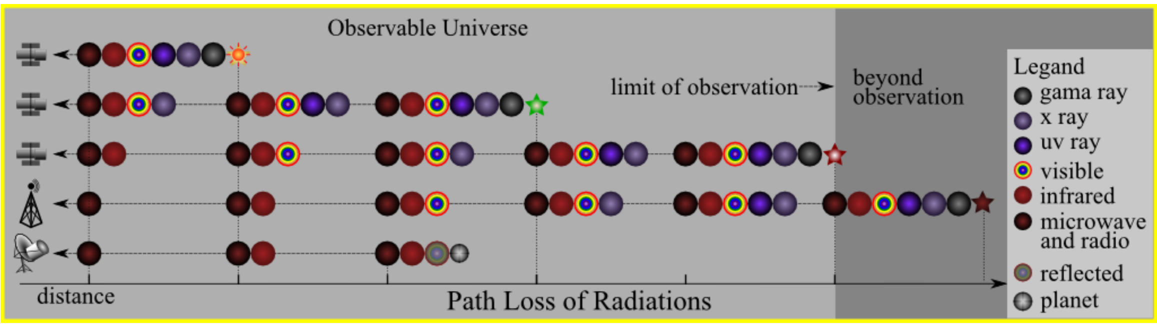

Figure 21: Path Loss of Radiations Over Distance

Since radiation detection is a duration, it is a segment of the radiations observed by the observer, shown as a string of color spheres (wavelets). Frequencies are shown in shades of colors. The missing sphere represents amplitude loss, and missing color is frequency lost. Here, we assume the distance of observation remains fixed, *i.e.* there is no Doppler effect.

High activity objects are represented by stars. The Sun is at the top of Figure 21, we receive the whole spectrum of radiations along with particles from it. Less active objects, such as planets (depicted as), are unlikely to emit high frequency radiations, or too weak to be detected due to their smaller mass and weaker activities. However, they will reflect the radiations (depicted as) from stars around them, and generate their own radiations in weaker and lower frequencies.

It is intuitive that majority of the high frequencies do not make it (in exponential proportion). Otherwise, high concentration of high-frequency radiations (UV, X, and Gama ray) will not allow life on Earth, or completely different life forms. Nevertheless, it would be very interesting if our biology has adapted to utilize infrared, UV, X, and Gama ray. Will we be supernatural beings? Under this thought, protection of high radioactivities by Atmosphere might not be a blessing, isn't it?

Now we study the translation in terms of Doppler effect. Since higher blueshift (lower negative z-value) is on it's higher frequency, and higher redshift (higher positive z-value) is on it's lower frequency. Blueshift will not survive as far, depicted in Figure 22.

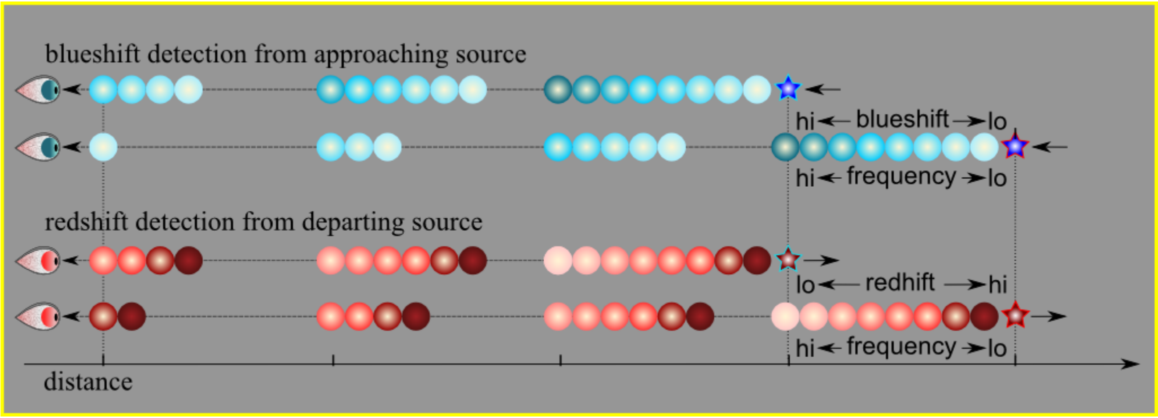

Figure 22: Top Frequency Loss of Doppler Effect over Distance

By dropping off top-end frequencies en route, both will arrive in last back-end of lowest frequency (longest wave-length). The difference is, blueshift is weaken, and redshift strengthen.

The higher weakening over distance, limited duration, and switch-over properties of blueshift make it harder to detect. The result is the same as the properties of Doppler blueshift in Section 2.10.1, smaller z-value and more often observed in closer range. On the other hand, all area outside of the blue disk is redshift' domain.

Redshift caused by Doppler effect is physically limited, however, redshift acceleration caused by path loss limitless. The energy of radiations can be fully absorbed by an obstacle in short time. The exponentially loss of top-end frequency over distance will be detected as proportionally accelerating redshift much larger than the physical limit of acceleration.

Comparing to the complications and significance of signal loss over distance on Earth, it can not be any less in vast distance of unknown space. I would say the positively exponentially proportional to the distance is also the nature of redshift alongside it's domination.

5 Cosmic Background Radiation

So far, the limit of observation is defined as the furthest distance we can reach in visual aspect. Currently 13.2 billion light years (bly) set by Advanced Camera for Surveys (ACS) and the Near Infrared Camera and Multi-object Spectrometer (NICMOS) of Hubble Ultra Deep Field (HUDF).

Low frequency radiations beyond HUDF's reach are not entirely undetectable by us. Since they can travel longer distance, low frequency radiations from objects beyond the visual detection of 13.2 bly can arrive. They can be detected in the range from microwave down to ultra long radio wave when we listen. It will be detected as Cosmic Background Radiation (CBR), as depicted in a simplified illustration in Figure 23.

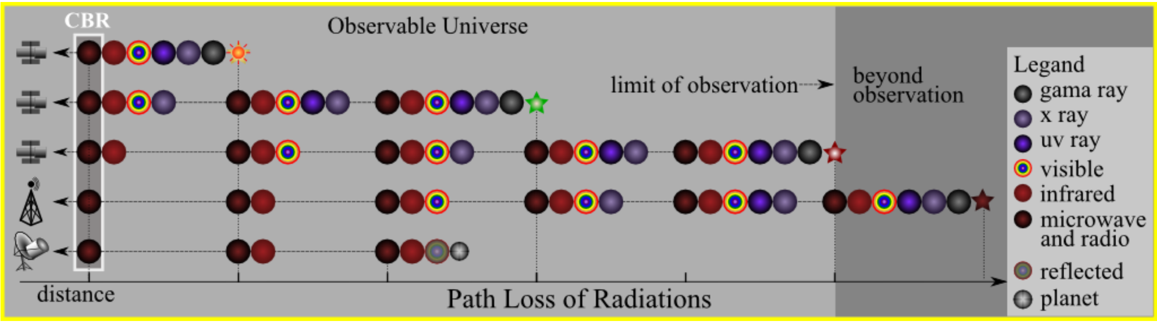

Figure 23: Cosmic Background Radiation (CBR)

In order to fill the space with radiations from all directions around an observer, the sources have to be distributed in all locations. Radiation is directional unless is reflected or deflected. In real life, a single source can not send the sound to a listener from more than one direction unless it is echoed. To hear it from all directions, it has to be echoed back (if not absorbed) from all surroundings. It is hard to believe a single source of radiations (Big Bang) can filled the universe from all directions. There was nothing in surroundings to reflect or deflect the radiations. Even if the remnant of Big Bang is still observable today, it has to continue to fade when the source does not exist any longer. However, I do not believe there is evidence showing CBR is fading.

The universe is not mute, but rather noisy. Electromagnetic radiations across the whole spectrum are creating constantly in all locations by all objects. I will not assume planets mute even they do not generate visual radiations. High and low radiations shall come from all objects, large and small, constantly. I expect there will be Doppler effect of Cosmic Background Radiation (CBR) if we can identify the source of the radiations and the original emitting frequency.

Very visual creatures of us love the stars, however, I believe the number of planets and planetoids can outnumber stars by many folds; Since it takers less material, energy, and time to construct small structure. Lack of high energy activities, they will not emit the full spectrum of radiations like stars, however, they will emit their own and reflect radiations from stars near-by.

Nevertheless, I believe redshift will not end at infrared. It can continue to be stretched or propagated further to microwave, short wave, and ultra long wave until all energy has been dispersed into the environment, however, not completely flat-line (absoluter zero). Due to the larger population of sources, low frequency radiations will fill the sky from all directions and distances we listen. This phenomenon will surround any observer, Earthing or alien, at any location in the universe.

I believe Figure 23 shows a logical explanation of CBR. It is an ongoing event of the universe. Other has passed, some is here, and more is coming. The generation of CBR will never end, or last as long as there is activity in the universe. Isn't it the same phenomenon of background noise created by all activities in and outside of a city?

6 Conclusion

Doppler effect is the result of physical displacement of the object in reference to the observer. It can create both blueshift and redshift effect. It is the result of physical motion of:

- object and/or
- the observer.

It is governed by laws of motion. It is limited by the inertia of the object and energy supply to alter it's momentum. There is no enough external energy in space to alter the intrinsic momentum of an object the size of galaxy; based on the facts that:

- the interstellar space is only about 4.26 °K (-268.9 °C, or -452 °F), and
- Cosmic Background Radiation is estimated to be 2.7 °K (-270.5 °C, or -454.8 °F).

Space will not be "cold" (or lack of activities) if there is mysterious energy-matter powering the such unimaginably vast number of galaxies. Milky Way and it's Local Group of galaxies are also remote galaxies. It is the remote region we can measure more accurately; and there is no evidence of it's accelerating. It means that Local Group is operating on it's intrinsic momentum, no extra energy is acting upon it. It would be paradox, by the laws of thermodynamics and physics, if other remote galaxies were receding physically.

From this study, accelerating redshift detected can not be the only result of physical displacement of the objects and/or Earthling observers. Since blueshift is the indication of collision, certainly I will not wish for high probability of blueshift. We love the drama of collision and explosion, however, the very low probability of blueshift suggests that, the universe is operating in much gentler manner. Personally, I view the celestial bodies are synchronized swimmers, gracefully dancing in the ocean of cosmos. Certainly, a gentle coupling of galaxies will appear supernaturally ferocious to us.

Reversely, blueshift is not the indication of shrinking space. Even if the observer is standing at the cross road of all incoming objects; where overwhelming blueshift will be detected; it is not an indicator of shrinking space unless all objects are affixed on space without freedom. The size of space is beyond measurement. It is impossible to know the size-change of space without references. There is no affixed markers or edge of the space, and there is no background to compare. The complete frictionless of space tells the fact that, the motion of any object is independent to space. Even there is a collision, blueshift detection tells the motion of passing-by object, not the action of space.

Doppler effect is the result of changing in distance of observation not the location of the object. On the other hand, path attenuation is subjective to the environment and the location (distance). Path attenuation can only create redshift, and it is positively exponential proportional to the distance, as indicated by the NED's redshift surveys. It is confirmed in our daily life and unavoidable. It can not be ignored for radiations over vast unknown space. By the natures of attenuation, the further the distance of observation, the more and higher redshift detection will be. It can easily overwhelm the Doppler effect. It has to be isolated from Doppler effect, if redshift is used to estimate the physical velocity of the object. Otherwise, it will create the illusion of accelerating receding easily exceed the inertia of the object, and the speed of light. Besides, only under 1.1% of the objects with redshifts are detected in NASA/IPAC Extragalactic Database. I doubt that we have sufficient information of hastening the fate of the universe and it's past.

The dominating and exponential natures of radiation redshift do not suggest the acceleratingly physical departure of all astronomical objects; and, neither inflation nor a common origin. Universe will continue as is, no extra matter and energy needed. Otherwise, besides the demand of run-away energy; the interactions among energy, matter, run-away energy, run-away matter, and acceleratingly expanding the space to carry objects away can only lead to run-away interpretations, and possibly science as well.

To me, it is obvious very majority of the radiations is lost over distance, otherwise sky will be filled with visible light and all other radiations, of which can be lethal to all lives. Redshift survey is very beneficial for space explosion. However, I believe not only we have under understood it, but also over interpreted it. We still don't know the true trajectory and velocity of Milky Way, let alone outer space celestial objects. I believe galaxy can transform and drift. Spiral trajectories we have observed in the sky likely be telling us the redshift and blueshift will come and go as much as the orbiting motion of celestial bodies.

Analogously, we are tiny bottom dwellers submerged in ocean of air. We can not ask the universe to send us high-definition radiations. We have to go out of Solar System and Milky

Way to explore the universe beyond. I am very certain our children will continue to reach further, since now I know that galaxies do not run away.

7 Appendixes

7.1 Paradox of Space Expansion

If detected redshift are interpreted as Doppler effect and attributed to the space expansion, these conditions ought to be true:

1. Space can expand and there is room for it to expand.
2. Space can carry objects, or it has friction.
3. Expanding space does not impose stress of accelerating on objects it is carrying.

However, there are paradoxes if the above assumptions were true:

1. Is there logical, experimental, or mathematical description of expansion of space?
2. Isn't the expansion of space defined by the enlargement of it's volume. Then, space has to be defined by it's surface and boundary if it can expand. However, space has no any point of reference. What is the volume of space other than infinite? and, what has room for space to expand other than space?
3. If there is room for space to expand, it can not have "temperature" higher than space. Otherwise it will expand into space and make space contract. What is this "room" that has temperature other than absolute zero? However, can it be absolute zero?
4. Isn't expansion also decompression? Doesn't space have to get colder? How cold and how rapid can it get if it is expanding faster than light-speed?
5. Earth and Milky Way is not the center of the universe. Milky Way and it's local group can also be considered remote galaxies. If there is any reason that other galaxies in all other sides are receding faster than light-speed, how could this region of space exempt? Isn't this the same perplexity that the Earth is the center of the universe?
6. Doesn't space have to have surface and friction to carry objects? However,
   (a) Space is outside and inside of any fluid in micro scale. Superfluidity can not be achieved if space has friction.

   (b) There will be matter/space surface interface if space has surface.

   (c) There will be frictions and surface interactions everywhere, since space can be at micro and macro scale; if space has friction or surface.

7. Will space generate it's energy or react to external force to expand? Not only it requires energy to expand the space, but also the energy to carry and accelerate the objects. Even if space expansion has no speed limit, how could it drag galaxies pass light-speed? I don't expect expanding and accelerating a region of no-load space can be the same when it is carrying heavy loads, *e.g.* galaxies and super massive black holes, etc., let alone faster than light-speed. Nevertheless, the energy requirement can only spiral into more mind-bending questions.

8. Isn't space the thinest fluid if it could expand, then doesn't it have to obey the laws of thermal and fluid dynamics? For example:

   (a) Will it's pressure decrease and temperature increase when space expands?

   (b) Doesn't the speed of thermal radiation has to keep up with the acceleration of space expansion faster than light-speed?

9. Can acceleration of space has zero g-force on free-riding objects, or somehow, the inertia of object does not react to the acceleration if it gets free-ride from space?

10. Can space contract, why if it can't, and how if it can?

Nevertheless, many paradoxes challenge or even overturn laws of physics if space could expand. I believe space expansion does not explain the accelerating redshift, instead it causes the inflation of contradictions and paradoxes.

7.2 Real Life Analogy of Inertia in Expanding Space

We have seen a house being carried downstream by flash flood. Different parts of the house are under different stress. For example, under or above water, materials or build in different parts of the house. It will be torn into pieces when the integrity of it's structure is lost. We also see the difference of a car or other structures being carried away by the flood.

Suppose there is a power-boat running in a river, refer to Section 7.3.1. It's momentum will be altered by current. If the boat is moving in circular motion (analogous to a rotating and orbiting galaxy), it will be under constant stress of acceleration and deceleration depending on the direction of the boat. The situation can get much worse if the boat encounters the accelerating rapids or waterfalls.

Similar to a power boat, galaxy is built with different substructures. It is operating under it's own intrinsic momentum of orbiting and rotating. If expanding space can carry it away, there will be acceleration and deceleration in different regions. Analogous to moving a gyroscope. It's structure will be under stress. Additional stress will be added if space accelerates. The inertial of the galaxy will fight back. Free-riding on the space expansion does not make the inertia of the galaxy (or any object) disappear. Even we do not know how much the structure of a galaxy can tolerate, but certainly, it has it's limit.

7.3 Paradox of Redshift and Expanding Space

For clarification, these symbols are defined as:

- z Detected redshift.
- z_d Doppler redshift caused by physical displacement of the source.
- z_c Light speed Doppler redshift, light-speed physical displacement of the source.

Using the simple redshift to velocity equation:

$$\textit{velocity of source } (v) = \text{speed of light (c)} * \textit{Dopple redshift } (z_d)$$

We have $z_c = 1$ for light-speed Doppler redshift and $z_c = -1$ for light-speed Doppler blueshift. T simplify it, $z_c = 1$ is used for light-speed Doppler redshift to avoid the complications of time dilation. However, it stands true regardless of the value of light-speed Doppler redshift, such as $z_c = 1.4$.[4]

When radiation is emitted from an object, there is one major difference when it is traveling in normal or expanding space:

The distance to travel for radiation is fixed at the emitted location in calm space ,

[4] any galaxy with a redshift greater than 1.4 is considered moving away from us (Doppler redshift) faster than the speed of light, Curious About Astronomy, curious.astro.cornell.edu .[2]

however, it continues to increase in expanding space. Radiation has to fight against the expanding space to travel through, it's arrival will be delayed or trapped.

A normal celestial object we see had head-start long ago. It's very first transmission of radiation had passed the late observers. However, no matter how early the head-start, radiations arrived have to travel trough the space that there is not expanding, or expanding slower than light-speed, at any location of the journey. Otherwise, it will be trapped and never arrive; Analogous to a swimmer going upstream studied in Section 7.3.1. It means the radiations we have observed can not come from the region of space that is expanding faster than light-speed, regardless of when the radiation is emitted.

In other words, the emitted radiation has to travel faster than the expansion of the space, otherwise it will be forever trapped. Since the top speed of radiation is light, the expansion has to be slower than light-speed to allow radiation to travel through to reach Earth. The Doppler redshift has to be smaller than light-speed, ($z_d < 1$), regardless of when the radiations have emitted.

It is easier to picture it with a supernova. In this case, observers have arrived earlier since we can observe it's beginning and end. It's first to last radiations will be trapped at first region of the space that is expanding faster than light-speed away from observers, and never arrive. This means the whole duration of supernova observed can not have Doppler redshift higher or equal to light-speed Doppler ($z_d \ngeq 1$).

In addition to radiation trap, expanding space will prolong the journey and delay the arrival of radiations, regardless space can carry or not. Delayed radiations by expanding space will intensify redshift, however it is not the Doppler effect, or not the result of receding galaxy. This stands true even a galaxy is moving toward the observer by itself against the expanding space. In all cases, regardless of a galaxy is still, receding, or approaching, the detect redshift of the radiation is not all Doppler effect, ($z \neq Z_d$). It also means the detected redshift of arrived radiations does not tell the whole truth about the velocity of the source, not to mention the expansion of the universe.

Nevertheless, it is impossible for radiation to travel faster than light-speed. It is also impossible for any structure to accelerate at speed faster than it can tolerate, even free-riding on space, refer to Section 7.2.

Besides, space expansion is paradox itself, (see Section 7.1). Expanding space does not provide the explanation of high redshift detected, but introduce many paradoxes.

However, not only we have detected redshifts higher than light-speed Doppler ($z > 1$, or $z > z_c$), but also proportional to distance. Considering the fact of dimmed lights of stars, very majority of the radiations did not make it through. The logical conclusion without any contradiction can only be:

Neither space can expand, nor carry. Detected redshift is a mixture of Doppler redshift and path loss($z \neq z_d$) in calm space. We know radiation disperses it's energy (amplitude and frequency) to it's surrounding proportionally to the distance of travel; And there is no limit to it's loss, $z \approx \infty$ when fully absorbed by an obstacle, or out of the detection capability of the device.

7.3.1 Real Life Analogy of Radiation Trap

First example is a drift-boat riding the river current, analogous to if space can expand and carry. Let say, there are physically equal swimmers jump off one-by-one at same interval and swim upstream, while the distance between the drift-boat and the headwater is increasing. In this analogy, the drift-boat is analogous to galaxy, swimmers to radiations, and river to the expanding space that is able to carry.

Second example is a boulder by the river, analogous to if space can expand but can't carry. Again, on-by-one at same interval, swimmers jump off from the boulder and swim upstream. The only difference is the boulder (analogous to a galaxy) is not receding from headwater. The starting location is the same for all swimmers.

Suppose there are observers coming to the headwater to log the swimmers. In both cases, current prolongs the journey and delays the arrival of swimmers. They will be forever trapped at first location when current flows faster than their top speed. Since there are swimmers arrived, there is no any part of the river is flowing faster than the swimmers. It does not matter when a swimmer has left the boat, nor the time a observer has come to the headwater.

In addition to this analogy, salmon can leap over rapids and waterfalls while the current is accelerating, nevertheless, it is impossible for radiations to exceed light-speed.

Let say, the similar event is played out from a rowboat on calm lake (analogous to calm space). All able swimmers will arrive regardless the speed and location of the boat. The difference of the arriving interval (rate) from one to the next will be the same if the boat is anchored, increase (redshift) if the boat is leaving, and decrease (blueshift) if the boat is coming back. In this case, the distance to swim is set by jump-off location, which depends on the speed and direction of the boat. The main difference is the distance to swim does not increase while swimmer is in calm water.

In a ll cases, it assumes weather is calm, and no any distraction to swimmers. The arrival rates will be altered by weather conditions. It will not tell the whole truth, if an observer only use the information of arrival rate to determine the distance and velocity of the boat or boulder.

It get even more complex in this analogy, if the water (space) is more than just superfluid. Not only, it is frictionless, but also has no surface, and there is no evidence that it will flow or carry. It is studied in Section 7.1.

7.4 Paradox of Constant Pulsating Quasars in Expanding Space

It is very unlikely, an object will emit radiations in fixed magnitude and frequency. Physically, radiation frequency (wave) is also pulsation. All radiations can be considered pulsation. A supernova event can be considered a single pulse radiation consists of many smaller pulsations. And, the observed pulsation period affected by the variation of distance of observation is essentially Doppler effect.

Pulsating radiations from quasar will arrive the same way as other radiations. Same as Doppler effect of radiations, the observed pulsating period is also affected by the displacement of Quasar. Thus, the detected Doppler effect has to be proportional to the observed pulsating period. Any change in distance of observation will alter the observed pulsating period concurs with it's Doppler effect. The main difference is, the prolonged effect of observation is unavoidable in expanding space. If quasar is involuntarily carried away by the expanding space, the observed pulsation period will always be longer than the actual pulsation period, and it has to be proportional to the change of distance, and it's Doppler effect. On the other hand, the observed pulsating period can coincide with the source in normal space, since the distance of observation can remains unchanged. It is also true for all pulsating radiations, including pulsar.

However, we have observed constant rate of pules from high-redshifted quasars. The study of astronomer Mike Hawkins[3] from the Royal Observatory in Edinburgh has found that quasars give off light pulses at the same rate regardless of their distance from the Earth[5]This can only be one of the following:

1. The change of pulsation coincides to the change in distance, the further the quasar recedes, the faster it pulses proportionally to offset the prolonged effect of observation. Which also means the pulsation has to concur with Doppler effect. It has to remain true whether the quasar is self-driven, externally propelled, or free-riding on expanding space.

2. There is no change in distance (or, no significant displacement). The redshift detected ($z \neq 0$) is not the result of Doppler effect.

Same as radiations in expanding space studied in Section 7.3, the distance to travel will be prolonged, and the arrival of pulse will be delayed by expanding space, regardless quasar can be carried away by space of not. The pulsation (pulsating rate, and duration of on and off) will be lengthened. It is impossible for quasar to adjust it's pulsation to match the expansion of space, which is supposed to be able to accelerate faster than light-speed with no limit.

Another paradox is, it is also impossible to detect the quasar with Doppler redshift greater than "1" in expanding space. The constant pulsation and detected redshift of quasar $z > 1$ can not be the result of Doppler effect, refer to Section7.3.

[5]Quasars Don't Show Time Dilation Mystifies Astronomers, Lisa Zyga, PhysOrg.com, April 09, 2010.[9]

7.5 Mind-Bending Questions

Motion of Objects Is One Thing And Expansion Of Space Is Another. Evacuating all New Yorkers and structures out of the area does not make New York state bigger, unless the boundary is expanded. Since New York has clear boundary, certainly, it will make all neighboring states very upset. Even if all objects are moving away from each other, it doe not mean the space is expanding, and we do not have the definition of boundary of space. The expansion of space can only be defined by the enlargement of it's surface and boundary, not by the motion of it's contains. Unless we have a clear observation of the enlargement of it's surface and boundary, we can not conclude the expansion of space.

Speed Of Expansion. Isn't it also true, that we can not measure the speed of space expansion by the motion of it's contains?

Tablecloth Tricks. When a table cloth is pulled away slowly, all dinnerwares on the cloth will move along, but not so if it is yanked away fast. All dinnerwares will remain where they are if the table cloth is frictionless. Likewise, a car can not be driven to any direction when there is no friction on the road surface. The fact that all objects are moving freely in space tells the reverse truth, that space is completely frictionless.

How To Prevent Raisins From Interacting With Dough? Free-riding raisins are trapped in the dough, however, raisins might not go along with the expansion of runny batter, but certainly will interact, *e.g.* exchanging moisture, sugar, air, and energy down to particle level. Both raisins and dough will also interact with the environment. *e.g.* dry up if baked or plum up if steamed.

Expansion Is Action, Load Carrying Is Interaction. To expand, space has to be able to act by itself or react to the energy applied. To carry galaxies, space has to be able to impose friction; then there will be resistance. If space acts or reacts, the complexity of interactions between space, matter and energy is beyond logical comprehension.

How About The Inertia Of Galaxy? A galaxy has to have inertia as any structure. It will resist the acceleration of any kind, self-driven, externally propelled, or free-riding on expanding space. Despite the size of galaxy, it is still a structure. It can not escape from the fundamentals of the universe. The structure of a galaxy will suffer from rapid acceleration. We all experience the g-force of acceleration and deceleration. All free riders on Earth will feel it if Earth accelerates. Many of us have experienced the earthquake and it's destructive force. Isn't it a small scale of acceleration and deceleration of Earth?

Nevertheless, I believe the rotational motion of an object will maintain stability of it's intrinsic momentum. Expansion of space has to overcome it's intrinsic momentum to carry it away. Not only expansion of space can not be proven, but also it's ability to alter the intrinsic momentum of an object is very questionable.

Holes In Expanded Space? Expanded dough would be filled with holes, space, and the property of the dough is also changed from interactions with the environment (and raisins). What will fill the void of expanded space, and how to make out of the expanded space? Besides, there is space for expanding dough, but where is the "space" for expanding space?

Mess Up Toppings And Dough Of Folded Pizza? Folding a pizza will mess up all toppings since topping as riding on the dough. The bent part of a line will disappear from original one-dimension, and move to two-dimensional space. So is the bent part of a plane will disappear from original dimensions and move up. Doesn't the bent part of space have to disappear from the universe? There is no evidence that space can act or react, bending space (if possible) does not mean the objects in it will go along. It is possible going up stairs on foot, however, I do not believe it is possible to go to the top of the building by bending the space in upper floor down.

Can Space Be Shipped? Shipping a tightly sealed empty container from Beijing to New York will take the air and other particles of Beijing to New York. However, will a piece of space of Beijing go to New York?

Why Space Is Not Helping Scientists? We are capable of manipulating matter and energy since our first existence on Earth, and scientists can do lot more in their laboratories. Unlike matter and energy, space is freely and infinitely available inside of all research facilities. If the ordinarily ingenuities couldn't, wouldn't scientists have done it already if space reacts? Besides, energy and matter, as small as subparticles, react to the most charm of our scientists, how could space, most intimate, always available, and largest thing we known, refuse?

Why Dark Matter-Energy Also Evade Scientists?

- How something of such magnitude can remain hidden?
  Consider these analogies:
  - A crowd of invisible bacteria, we see colorful display of hot springs in Yellowstone.
  - Put together enough invisible particles, we see an elephant.
  - Gathering a pinch of the total matter-energy of the universe, there is the Sun.
- Yet, there is no single grain of dark-matter dust can be found.
  - Isn't is very possible they are in the laboratories with scientists, if they exist?
  - Why and how, such massive actions of pushing the universe apart, and yet space is very "cold"?

How To Prevent Dark Matter-energy From Interacting? Since dark matter-energy also share the space with matter and energy; if they could expand the space and pushing galaxies apart, why don't they interact with matter and energy?

Is There Dark Universe Or Hybrid Universe?

- We know the universe is capable of creating structures, from simple to complex intelligent beings with matter and energy; why it is not taking the advantage of abundant dark matter-energy?
- If dark matter-energy don't interact with matter and energy, but only to their kind, wouldn't there be a large dark universe and a small universe?
- On the other hand, is the universe hybrid?

Is Primeval Atom Absolute Zero? Unless there is no motion, absolute zero, elementary particles can not be confined in a point space. It raises many big questions:

1. What was before the primeval atom came to be?
2. How the primeval atom (seed) of the universe came to exist, if there was no universe beforehand?
3. We know how and physics of keeping carbon dioxide tightly packed into a diamond, and it is impossible to make it smaller. How could universe be at a single compressed point origin?
4. We know how seed grows, but what triggered the initiation of primeval atom?

By logic and all the experiments we have done, absolute zero can not be achieved. Unless all energy is removed and stored in other complete isolated location, an atom will not stop it's motion, let alone it's subparticles. And, there is no such other location in the universe, let alone the other location didn't exist before Big Bang. I don't believe there is any physical fact (nor logical explanation) of confining elementary particles, such as electrons and neutrinos. Beside, they can be at multiple locations by current interpretation. On the other hand, how could Big Bang initiate itself when there was no matter, no energy, and no space inside and out? Isn't Big Bang a paradox, dug itself into a endless hole the size of a point?

How Structures Were Built With Rapid Expansion? Big Bang imposes the intrinsic point outward momentum (radial trajectory) on all matter and energy. All particles will have to depart from each other by heritage, wouldn't neutrinos fly away far from everyone first?

- Propelling by the most powerful outburst force of Big Bang; wouldn't speedy subparticles such as neutrinos be long gone with no resistance?
- Wouldn't particles with stronger inertia be left behind?
- How they meet and interact to structure elements when their intrinsic momentum are radial?
- Can the universe function without those first ran-away particles in such endless racing apart?

What Happened With The Reaction Of Big Bang?

- Isn't there an equal force of inward reaction (collapse) from Big Bang, an ultimate black hole?
- Wouldn't it be easy to detect a black hole of this magnitude, right at the center of cosmic background radiations?
- Were half of the total energy and mass of the universe trapped in this ultimate black hole, or we only have half of the universe?

7.6 Can We Really Tell The Size & Age of The Universe?

Suppose NED's information (Section 2.6) is obtained with perfect vision and no signal loss. The percentage of blueshift detected from NED is:

$$\begin{aligned}\overline{p}(r) &= \frac{\text{blueshift objects}}{\text{Total objects accounted}} \\ &= \frac{9,311}{4,204,329}\end{aligned}$$

From equation $P(r) = \frac{5}{16}r^3$, we can estimate the distance ratio(r):

$$\begin{aligned}\overline{r} &= \sqrt[3]{\frac{16}{5}\overline{p}(r)} \\ &= \sqrt[3]{\frac{16}{5}\frac{9311}{4204329}} \\ &\approx 0.1920805\end{aligned}$$

Then, we only have reached to 0.1920805 of the universe at the distance of 13.2 bly (billion light years) set by Hubble Ultra Deep Field (HUDF). To estimate the radius of universe in terms of NED's database, the radius will be larger than 68 bly ,

$$\frac{13.2}{0.1920805} \approx 68.7211989$$

The lower limit of HUDF is near infrared. The rough estimate here is merely the minimum visible part of the universe we can detect. It is based on the radiation activities above infrared. However, the sky is filled with long reaching lower frequencies (CBR, studied in Section 5). I don't believe redshift will stop stretching at infrared. Despite we are unable to identify the source, low frequency radiations from outside of the detectable universe can arrive. Considering the all-encompassing CBR, and the long reaching able of low frequencies; much larger universe is not exaggeration logically. The question is, will we ever know if there are objects outside of the detectable universe radiating in wave length longer than CBR? We only measure the universe with radiations, however, there are activities of elementary particles which can not be detected by us? Isn't' it impossible to picture how far some active objects, say neutrinos, can be other than infinite.

Furthermore, suppose we have perfect telescope that is limitless in range; And, we don't see anything when we look pass all objects; Can we say we have reached the edge of the Space or Universe? Or, there is infinity beyond Space?

On the hand, can we really say how old it is? Since inaction is also action (or an event of inactivity), can we say there is no universe even there is no activity in it? Can we tell how old the elementary particle is? Or, there is something older? Isn't it human arrogance facing the mighty universe?

Nevertheless, since it is already here undeniably, I accept that the universe has no center and no beginning-ending. I will take the universe as is; rather than chasing my tail, or back of my head.

7.7 Accumulated Probability Distribution

Table 5: Accumulated Probability Distribution of Blueshift Detection, P(r)

r	(%)	r	(%)	r	(%)
0.00	0.00	0.01	0.00000008	0.02	0.00000128
0.03	0.00000641	0.04	0.00002000	0.05	0.00004883
0.06	0.00010125	0.07	0.00018758	0.08	0.00032000
0.09	0.00051258	0.10	0.00078125	0.11	0.00114383
0.12	0.00162000	0.13	0.00223133	0.14	0.00300125
0.15	0.00396564	0.16	0.00513281	0.17	0.00654045
0.18	0.00821949	0.19	0.01020278	0.20	0.01252502
0.21	0.01522279	0.22	0.01833455	0.23	0.02190063
0.24	0.02596323	0.25	0.03056644	0.26	0.03575621
0.27	0.04158038	0.28	0.04808864	0.29	0.05533259
0.30	0.06336567	0.31	0.07224323	0.32	0.08202246
0.33	0.09276244	0.34	0.10452414	0.35	0.11737038
0.36	0.13136587	0.37	0.14657719	0.38	0.16307280
0.39	0.18092303	0.40	0.20020009	0.41	0.22097805
0.42	0.24333287	0.43	0.26734239	0.44	0.29308631
0.45	0.32064620	0.46	0.35010554	0.47	0.38154965
0.48	0.41506573	0.49	0.45074286	0.50	0.48867201
0.51	0.52894600	0.52	0.57165955	0.53	0.61690922
0.54	0.66479348	0.55	0.71541267	0.56	0.76886897
0.57	0.82526648	0.58	0.88471116	0.59	0.94731083
0.60	1.01317520	0.61	1.08241585	0.62	1.15514624
0.63	1.23148169	0.64	1.31153942	0.65	1.39543851
0.66	1.48329991	0.67	1.57524646	0.68	1.67140285
0.69	1.77189568	0.70	1.87685339	0.71	1.98640633
0.72	2.10068668	0.73	2.21982855	0.74	2.34396787
0.75	2.47324250	0.76	2.60779212	0.77	2.74775832
0.78	2.89328456	0.79	3.04451617	0.80	3.20160035
0.81	3.36468619	0.82	3.53392464	0.83	3.70946854
0.84	3.89147259	0.85	4.08009336	0.86	4.27548933
0.87	4.47782081	0.88	4.68725002	0.89	4.90394104
0.90	5.12805982	0.91	5.35977419	0.92	5.59925386
0.93	5.84667042	0.94	6.10219731	0.95	6.36600987
0.96	6.63828530	0.97	6.91920270	0.98	7.20894300
0.99	7.50768905	1.00	7.81406258	r	1/100

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