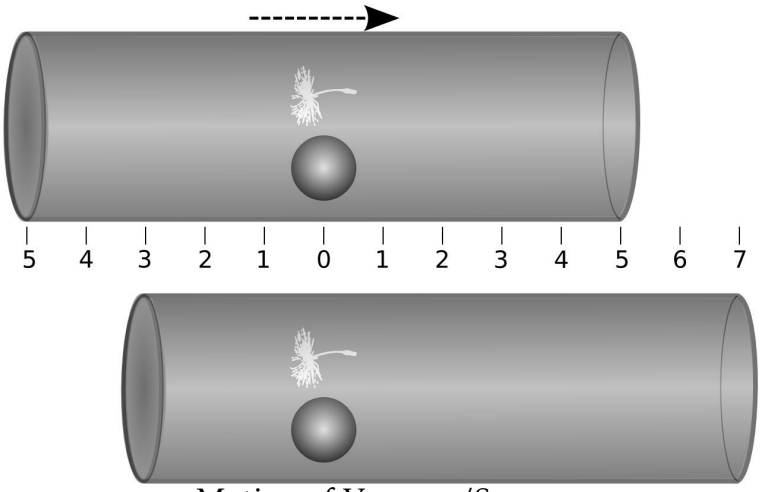
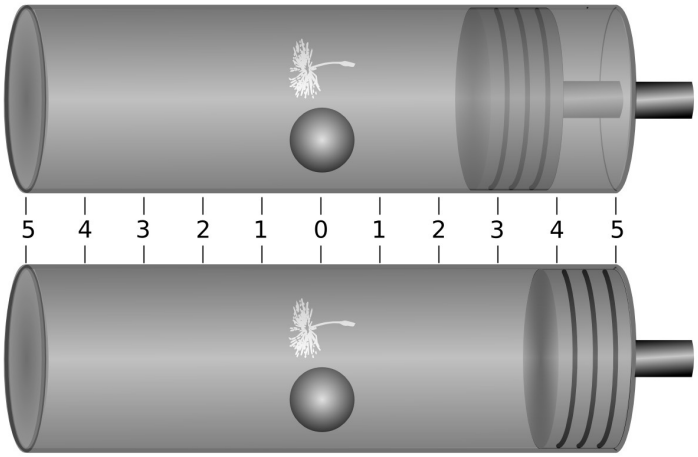
Pitfall of Space Expansion
空間擴張的陷阱

Cres Huang



Motion of Vacuum/Space



Expansion of Vacuum/Space

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Edition: 2014(01)-preview
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cres@mail.org

Abstract

The dominating and proportional cosmic radiation redshift has been interpreted as the result of space expansion. However, it also causes many confusions and paradoxes, since it implies these assumptions:

- Space can expand and there is room for it to expand.
- Space can carry, or it has friction.
- Expanding space does not impose accelerating stress on riding structures.

Analogous to an infinite vacuum, space is completely frictionless. It has no surface, and can only be regarded as absolute zero viscosity. Expansion of the space, if possible, will not drag anything along. It would just flow through and zip away by itself, leaving everything untouched.

To expand, space has to be able to act and react. To carry, space has to be able to impose friction; then there will be resistance. Even if the space could carry and tolerant unlimited acceleration, but not the galaxies, analogous to a fighter jet and the pilot. We have learned to manipulating matter and energy since our first existence on Earth, but, never space.

Besides, it is impossible to detect receding redshift ≥ 1, in expanding space. In other words, arrived radiations can not have receding redshift equal or greater than light-speed receding, if space was expanding.

It is also impossible to detect constant pulsation with Doppler redshift in expanding space. Pulsation is also frequency of waves. It has to be stretched or compressed precisely concise with it's Doppler effect of radiations, in spite of space could expand or not. However, constant pulsating quasars with high redshift have been observed. It proves that high redshift of quasar is not the indicator of receding. It also disproves the expansion of space.

Space is absolutely independent of matter and energy. Expansion of the space would intertwine with many paradoxes that is beyond comprehension. This article will study the pitfall of space expansion by comparing it with the real life analogy.

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1 Introduction

The dominating and proportional cosmic redshift has been interpreted as the Doppler effect of space expansion. However, it also causes many confusions and paradoxes. 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 is 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 carry, or it has friction.
- Expanding space does not impose accelerating stress on riding structures.

I believe these issues have been overlooked:

- Space is completely frictionless. It has no surface, and can only be regarded as absolute zero viscosity. Expansion of the space, if possible, will not drag anything along. It would just flow through and zip away by itself, leaving everything untouched. 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. Even if the space could carry and tolerant unlimited acceleration, but not the galaxies. Analogous to a fighter jet and the pilot.
- Free-riding raisins are trapped in the dough, however, they might not go along with runny batter, but certainly will interact, *e.g.* exchanging moisture, sugar, air, and temperature. Both raisins and dough will also interact with the environment, *e.g.* dry up if baked or plum up if steamed. If space could expand and carry, it has to interact. Analogous to air and airplane.
- It is impossible to detect Doppler redshift ≥ 1 (light-speed Doppler redshift) in expansing space. Analogous to swimmers going upstream slower than the current.
- It is also 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 of it's radiations. However, a study by Mike Hawkins has shown the constant pulsating quasars with high redshift.[1] It proves that the redshift of quasar is not the Doppler effect of it's receding.

Consider these:

- When a table cloth is pulled away slowly, all dinnerwares riding on the cloth will be dragged along, but not so if it is yanked away fast. All dinnerwares will remain where they are if the table cloth has no friction.
- A car can not be driven to any direction when road surface has no friction.
- Air is capable of interactions. It has friction and surface. It is able to carry airplanes, and the motion of airplanes will create turbulence of air. Successively, the motion of air disturbs the airplanes in flight. However, expansion of air is not necessarily able to carry all objects away. The physics is different when air is moving free or load bearing. The same goes to any fluid.
- Space is inside and outside of all structures. There would be frictions and surface interactions in micro and macro scale, if space had friction or surface.
- Space is also inside and outside of any fluid. Superfluidity can not be achieved if space has friction.
- Fluid mechanics and thermodynamics have been closely studied. However, space, most intimate, abundant, and always available, is out of reach, even it is in our hands.

A brief experiment of the space is depicted in Section 7[3]. We can only describe space with an infinite vacuum. Free-moving objects are not anchored nor riding on space. It is absolutely independent of matter and energy.

However, expansion of the space would intertwine with many paradoxes that is beyond comprehension. This article will study the pitfall of space expansion by with the help of real life analogies.

[1] Mike Hawkins, *On Time Dilation in Quasar Light Curves*, Royal Observatory in Edinburgh; DOI:10.1111/j.1365-2966.2010.16581.x

2 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 many 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. 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?
4. 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?
5. Earth and Milky Way is not the center of the universe. Milky Way and it's local group as remote galaxies too. 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, 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 run-away mind-bendings.

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? Doesn't the speed of thermal radiation have 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.

3 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 4.1. 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.

4 Paradox of Redshift & 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. To 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 $z_c = 1.4$.[2]

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

> *The distance to travel for radiation is fixed at the emitted location in calm space , 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 4.1. 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.

[2] any galaxy with a redshift greater than 1.4 is considered to be moving away from us (Doppler redshift) faster than the speed of light, Curious About Astronomy, curious.astro.cornell.edu .[1]

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 the observer, 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 3.

Besides, space expansion is paradox itself, (see Section 2). 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 observer.

4.1 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 2.

5 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 as 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[2] 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[3]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 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 4, the distance to travel will be prolonged, and the arrival of pulse will be delayed by expanding space, regardless quasar

[3]Quasars Don't Show Time Dilation Mystifies Astronomers, Lisa Zyga, PhysOrg.com, April 09, 2010.[4]

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 Section 4.

6 Conclusion

From the above study, the expansion of space does not provide answer to the dominating and proportional cosmic redshift. On the contrary, it has mushroomed into more ambiguous interpretations. Many mind-bending questions can not be explained logically, Section 8.

Path attenuation is unavoidable and closely studied in many fields on Earth. It is also in our daily life, *e.g* radio reception, whistle of an ocean liner, sight, sound, and other delivery of information. Radiations will not travel through perfect vacuum environment. The fact that there is no absolute zero in space means that there are activities in space. Radiations will not be able to travel trough with complete quality intact. The velocity, magnetite, and frequency will be altered en-route to Earthling observer. A minute variation will have vast leverage over the cosmic distance, and it can only be exponential. Due to the astronomic distance of celestial observation, it would easily overwhelm the Doppler effect, and create the illusion of run-away universe.

I believe it is essential to study radiation redshift in other angles. Otherwise, it can only lead to more run-away interpretations, and possibly science as well.

7 Appendix - A Brief Experiment of Space

Among the three fundamental elements of the universe; space is as real, however, most illusive. It has existence but not physical. It is intangible, however, felt very tangible by us. It is beyond any measurement. It's always right there, but can never be detected by any instrument. It is intimate, but, distanced beyond our imagination. It is very hard to give it a definition, or prove it's existence mathematically. However, we can not deny it's always here with us and we all live in it. Nevertheless, it has caused some confusions of our understanding of the universe, when dominating and proportional cosmic redshift has been interpreted as the result of space expansion. I believe it is fundamental to have a clear understanding of this fundamental of the universe.

We have learned to manipulating matter and energy since our first existence on Earth, however, never space. Even it is impossible to study space hand-on. However, there is vacuum that shares many properties of space. Fortunately, we can create and shape vacuum to an extent. By isolating matter and energy, we can create man-made vacuum that is observable. When matter and energy are absent, the important nature of space would surface.

We can consider space is an infinite perfect vacuum, and vacuum a window to view the nature of space. Studying the actions of vacuum, mass, and energy would help us deriving a logical understanding of space.

7.1 Space and Vacuum

We often consider space is vacuum, or emptiness. However, there is no perfect vacuum in real world. Completely absent of matter and energy also means absolute zero. We can not completely remove particles from a volume, not even in outer space. I don't think it is possible to isolate subparticles with walls made of particles and energy. The size and rapid action of subparticles make them beyond restriction.

However, when we remove most of the detectable matter from a volume, the nature of vacuum can be observed. Here we summarize the properties of vacuum:

- It has no mass,
- contains no energy,

- actionless or absolute zero ,
- frictionless or zero viscosity,
- incapable of any interaction, and
- weightless.

The nature of vacuum basically is the property of absence, or emptiness. The fact is, even vacuum can not exist without space. Nevertheless, space also posses the property of absence.

Man-made vacuum is confined, but space is limitless. It is larger than any matter and energy we can detect. Even if we have a perfect telescope that is limitless in range; And, we don't see anything if we could look pass all objects; Can we say that we have reached the edge of the space?

The logical interpretation of space without any paradox can only be, the space is an infinite emptiness. It has existence, however, it's shape and size can not be measured.

7.2 Space and Friction

Here, we repeat the famous Galileo's experiment with a ball and a dandelion seed free-falling in a vacuum chamber, Figure: 1. It shows us that falling objects would fall with uniform acceleration in vacuum, regardless of their shape, size, or compositions. The truth is, a simple experiment since 1589 tells more than just gravity.

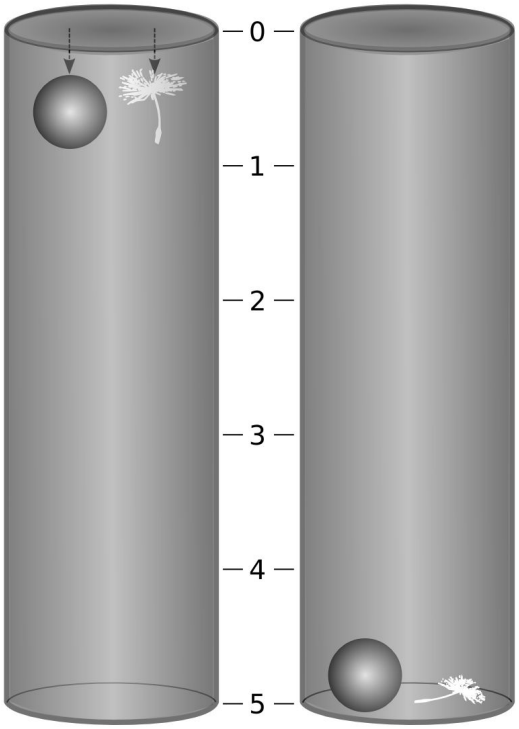

Figure 1: Free Fall in Vacuum Chamber

Even the ball and the seed have structure and surface, and both are capable of surface interactions, however, vacuum is not. It would not disrupt the fall. The ball and the seed will descend in identical acceleration and land at the same time. It shows the truth that the vacuum has no friction. It also shows the reverse truth that the motion of the ball and the seed can not disturb vacuum.

We know the chamber is vacuum, however, there is space. It also shows the fact that the space would not alter the fall, it is also frictionless, and neither does it have surface and it is unable to interact.

7.3 Space and Motion

Suppose the charmer is moving upward during the fall, as depicted in Figure 2. The only differences is the shorter distance of fall and the landing impact. The motion of the chamber would not intervene the fall, as long as it does not contact the ball and the seed during the fall.

Here the vacuum has moved up with the chamber. It shows the fact that the motion of the vacuum would not alter the fall. I would say the space also does not disturb the fall. However, there is no clue that space has changed in any way. It has to remain undisturbed, otherwise, there will be illogical paradoxes.

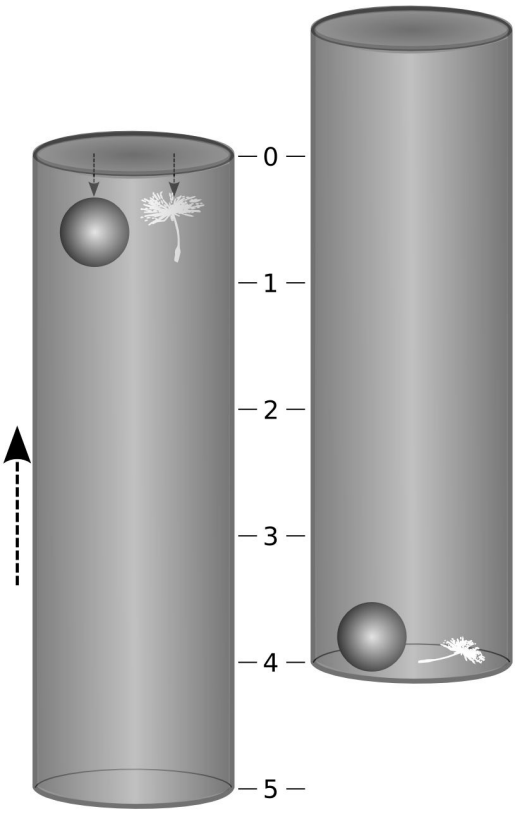

Figure 2: Free Fall in Rising Vacuum Chamber

Suppose we do the same experiment in zero gravity field. Here we right-shift the chamber, as depicted in Figure 3:

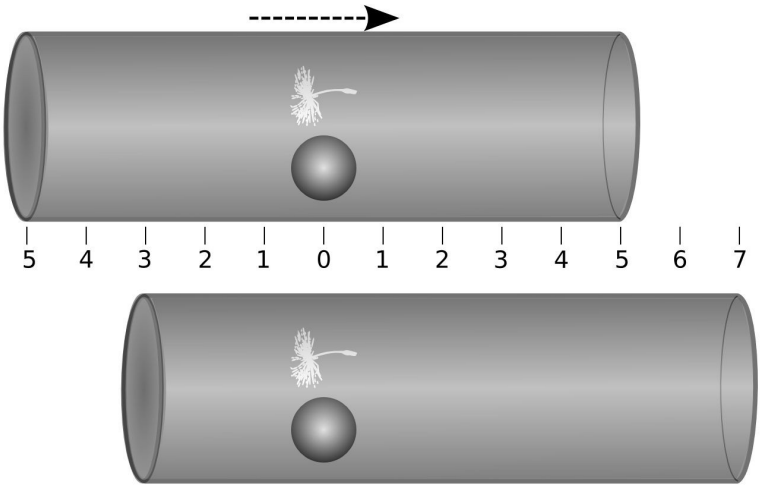

Figure 3: Vacuum Chamber in Zero Gravity Field

Again, vacuum has shifted with the chamber, however, the result can only be the same as in gravity field, the ball and the seed would not move along. The motion of vacuum would not disturb the ball and the seed as long as there is no physical contact. I would say neither the vacuum nor the space will carry objects, and space remains independent of all objects and actions, even the displacement of vacuum. Figure 4 is an animated illustration. Please note that some PDF viewer might not display it properly.

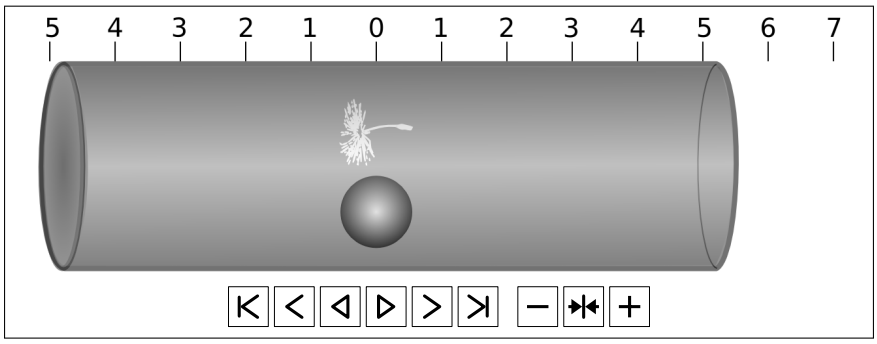

Figure 4: Vacuum Chamber in Zero Gravity Animation

On the other hand, we know that chamber, ball, seed, and resin will all shift together if the chamber is filled with resin, as depicted in Figure 5.

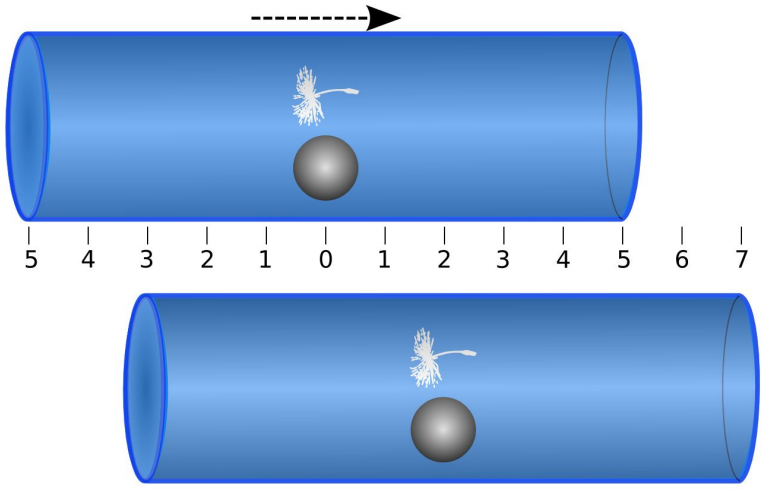

Figure 5: Resin Filled Chamber in Zero Gravity Field

Certainly, the result will be different if the chamber is filled with gas or liquid. There will be interactions playing out by the laws of motion and fluid dynamics, which is not within the scope of this study. Figure 6 is an animated illustration. Please note that some PDF viewer might not display it properly.

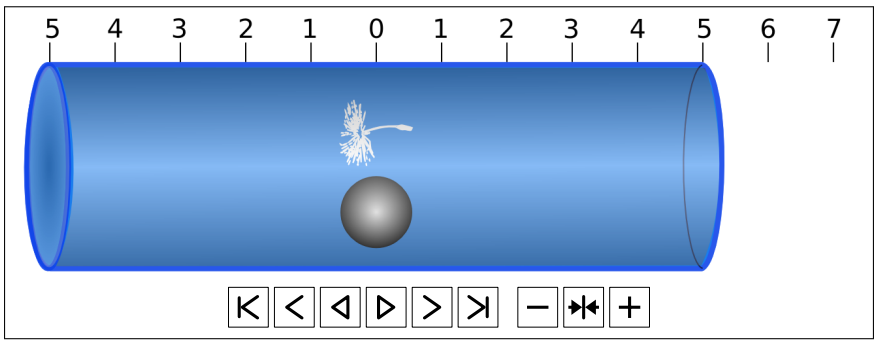

Figure 6: Filled Chamber in Zero Gravity Animation

7.4 Space and Expansion

Suppose we have a vacuum cylinder equipped with piston, as depicted in Figure 7.

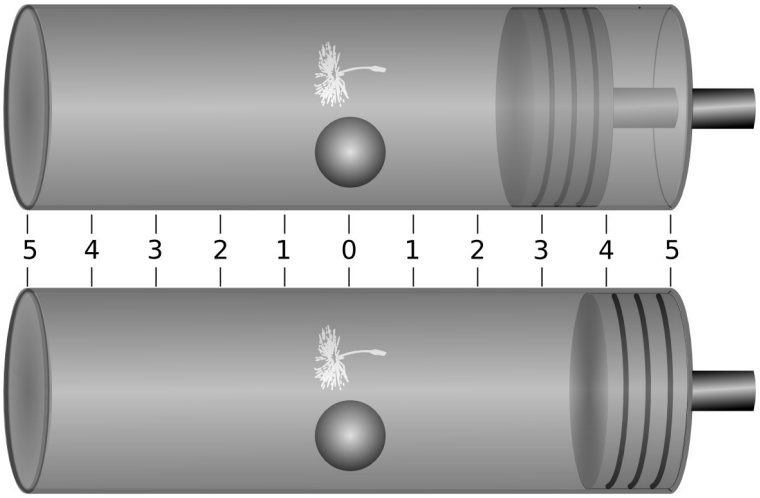

Figure 7: Vacuum Cylinder in Zero Gravity Field

Here we can compress or expand the volume of vacuum with this device. However, neither the compression nor the expansion of vacuum would displace the ball and the seed, as long as the piston does not come in contact with the ball and the seed. In this experiment, I would say neither space is capable of displace object, nor the space has been compressed or expanded. Figure 8 is an animated illustration. Please note that some PDF viewer might not display it properly.

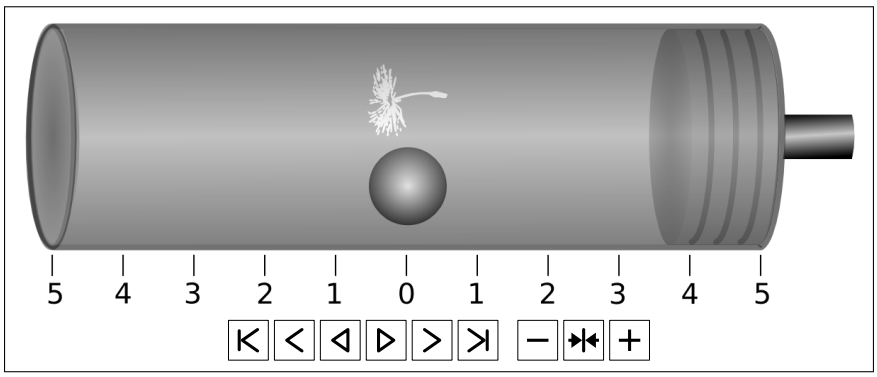

Figure 8: Vacuum Cylinder in Zero Gravity Animation

7.5 Space and Compression

Suppose we have two cylinders. One is filled with air, and the second one is vacuum, as depicted in Figure 9:

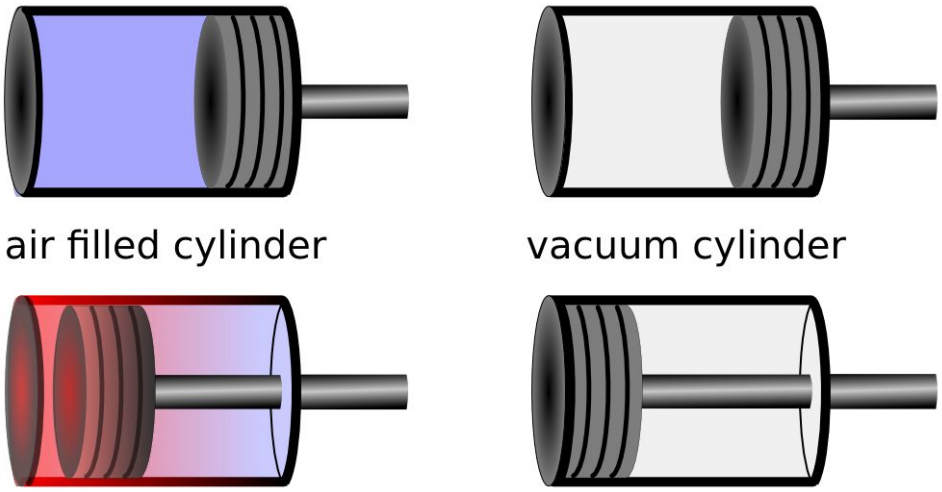

Figure 9: Compression of Cylinders

Here, we ignore the surface interaction (friction) of the cylinder walls and the pistons. The interior space would get smaller when the piston is pushing in. We understand the air filled cylinder will heat up when the air is compressed, and the piston can never fully reach to the end, unless in the cases of cracked cylinder or airtightness is lost.

On the other hand, the piston of the vacuum cylinder will reach to the end, and there is no energy released. The piston has relocated, and the vacuum has disappeared. In this case, vacuum is finite, and it can be created and shaped.

Nevertheless, we can not detect the edge nor the surface of the space has changed in both cases. We can only say the space is not effected, and it can not be confined. It remains

independent as is. It is not disturbed by the existence of the pistons and cylinders, and the motion of pistons.

7.6 Space and Energy

Suppose we have two sealed capsules made of heat resisting material. One is air filled and another one vacuum, Figure 10.

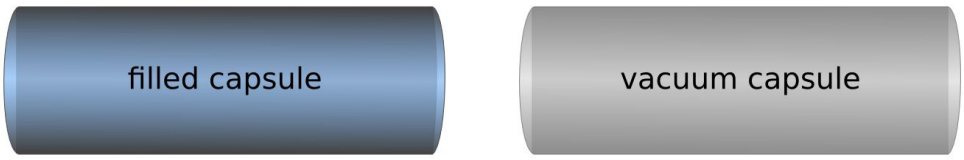

Figure 10: Filled and Vacuum Capsules

Suppose extra energy, heat, is applied to both capsules. We understand the added energy to the filled capsule will cause the air molecules to get excited and expand. The interior pressure will increase. It will force the capsule wall to bulged out. I believe "likely to explore" is also your answer to the filled capsule, since we know the internal pressure can excess the capsule wall can withstand, as depicted in Figure 11.

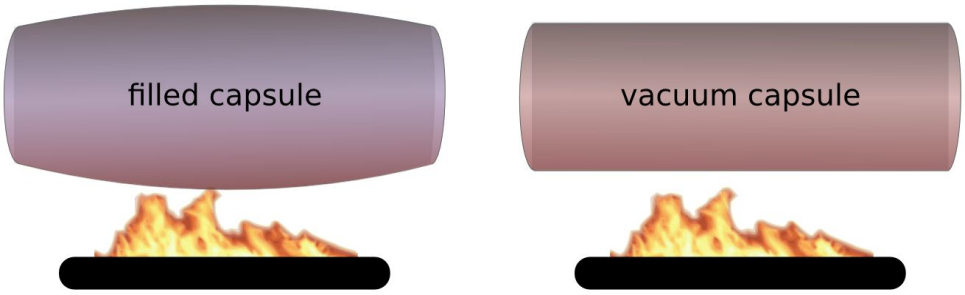

Figure 11: Heated Capsules

However, is your answer the same for vacuum capsule? Here the issues become:

1. Would vacuum expand?
2. Would space expand?
3. Would space react if the filled capsule explores?

Can we answer yes to these questions?

The added heat can only be absorbed by the vacuum capsule wall. It would maintain it's shape as long as the extra heat is within the tolerance of the capsule material. However,

instead of explore, the capsule would collapse if atmospheric pressure excess the capsule wall can withstand.

Here, matter, air and capsule, would react to applied energy, but not vacuum. The added heat has no direct effect on vacuum, neither space.

7.7 Summary

We can only best describe space is an infinite vacuum, or endless emptiness. It's boundary and surface can not be defined. If it is finite, there must be something outside, yet, it can only be described as an endless vacuum outside. However, even vacuum can not exist without space, then space has to be outside of the finite space. It can only be infinite in this endless chase.

Here, the properties of space is summarized as:

- Playing-field for mass, energy, and action.
- Massless, shapeless, and weightless.
- Actionless or absolute zero.
- Contains no energy.
- Frictionless or zero viscosity.
- Incapable of any interaction.
- Coexists with all objects.
- Beyond measure.
- Absolute independent.
- Absolute integrity. It's properties and location never alter.

The power of space is it's shapeless, actionless, and timeless. It is not affected by mass or force, even supernova can not dent it. Consider space has room for the universe. Let anything move free without any restriction, but nothing can escape from it. It has nothing, but nothing can come to exist without it.

I believe space is the only element that can exist by itself. No event can take place unless the playing field is set first. No construction can start unless the space is readily available. I would say if we would ever discover the origin of the universe, space comes first. Isn't it the ultimate power mightier than anything?

8 Appendix - 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 ex-

panding 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 re-

acts? 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?

References

[1] Cornell University; *Curious About Astronomy*
http://curious.astro.cornell.edu/question.php?number=575

[2] Mike Hawkins; *On Time Dilation in Quasar Light Curves*, Royal Observatory in Edinburgh
DOI:10.1111/j.1365-2966.2010.16581.x
http://http://mnras.oxfordjournals.org/content/405/3/1940

[3] Cres Huang; *A Brief Experiment of Space*, 2014/11, ISBN 978-957-43-1996-1(paperback), ISBN 978-957-43-2027-1(PDF), National Central Library of Taiwan
A Brief Experiment of Space

[4] Lisa Zyga; *Quasars Don't Show Time Dilation Mystifies Astronomers*, PhysOrg.com, April 09, 2010
http://phys.org/news190027752.html

Your advices and corrections are appreciated. Please send your correspondence to: cres@mail.org

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