Uncovering the limited application range of the Doppler effect to review the existing necessity of dark energy

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Abstract

Today, the scientific community comprehensively accepts the viewpoint of the accelerating expansion of the universe and the existing necessity of dark energy. But, if we trace back to the initial theory that ultimately leads to this conclusion, it is the Doppler effect that assumes an equivalence between the frequency shift of the wave sent from an object and the change in the distance between the object and the observer. We argue that, just like the equivalence in Newton's inertia law that cannot apply to all phenomena but is limited to 'macro, low-speed, inertia system', the equivalence behind the Doppler effect also has a corresponding limited application range and the remote object actually exceeds its application range. If we insist on adopting this unsuitable method to measure the change in the relative distance between remote celestial bodies and us, large-scale red shift inevitably misleads us to the cosmic accelerating expansion. To artificially expand the application range of the Doppler effect and force it to apply to all phenomena, we have to assume the whole universe is flooded with a quite high proportion of dark energy that is defined to be incapable of interacting with the electromagnetic wave.

Keywords: dark energy; Doppler effect; accelerating expansion; electromagnetic wave.

Contents

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1 Introduction

Since the Doppler effect, cosmic accelerating expansion has become a common viewpoint. Until today, the current physical system has never discussed the application range of the Doppler effect but defaultly regards it can apply to all phenomena. Considering the Doppler effect can be viewed as a method to measure the relative distance between the object and the observer, to figure out whether it can really apply to all phenomena, we need to start from the general principle behind phenomena measure.

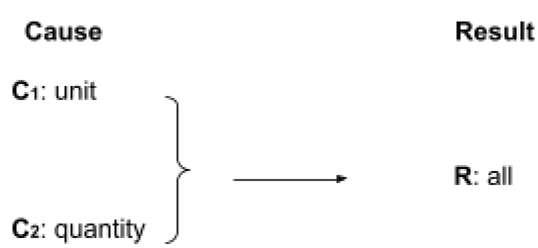
2 The general principle of phenomena measure

First of all, we cannot directly perceive reality itself but various phenomena, which are generated via the interaction between observers' sensors[2] and reality. Any phenomena, either perceived or non-perceived, can be taken as an intersection of several finite properties simultaneously fixed at a certain degree. In short, denote $A_i, i = 1, 2 \ldots k$ are all finite properties. For any phenomenon denoted as P, there are some fixed degrees of A_i, denoted as a_i, then

$$P \approx \bigcap_i \{A_i = a_i\} \tag{1}$$

Further, we can also perceive one phenomenon occurring after another. If this occurrence always happens without exception, it constitutes a causal relation. For example, based on 'any big things is constituted by smaller things', a causality about quantity can be abstracted as below. To differentiate with other causal relations, we denote it as causality Ⅰ and A→B represents that B is the result of A.

causality Ⅰ

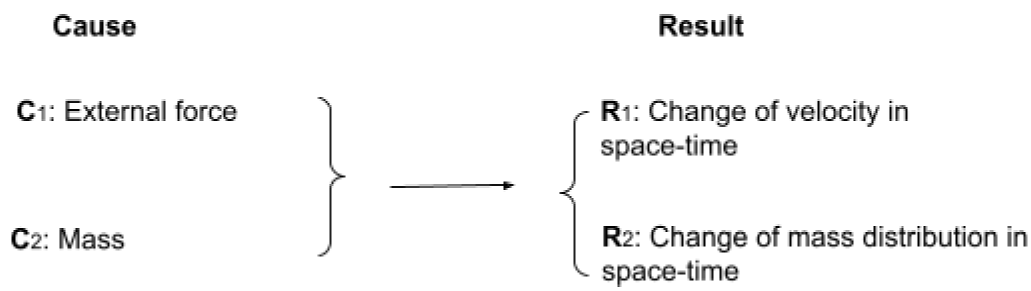


Similarly, when we push something in daily life, some change can be observed in either the object's speed or its motion direction, which can be unifiedly described as 'change of velocity in space-time'. However, this is an unrigorous causality because it does not describe all the possible situations. If we

[2] Sensors here refers to not only the natural sensor, e.g. eyes, ear, but also the technique aids or tools that extend the perception scope of observers, e.g. telescope, microscope, etc.

increase the strength of the force to a certain degree, the object may be either deformed but still as an integrity or shattered into pieces, which can be unifiedly described as ‘the change of mass distribution in space-time’. Thus, two causes of ‘force’, ‘mass’ and two results of ‘change of velocity in space-time’ and ‘change of mass distribution in space time’ constitute a rigorous causality that completely reflects all relevant situations that could possibly occur in reality, denoted as causality Ⅱ.

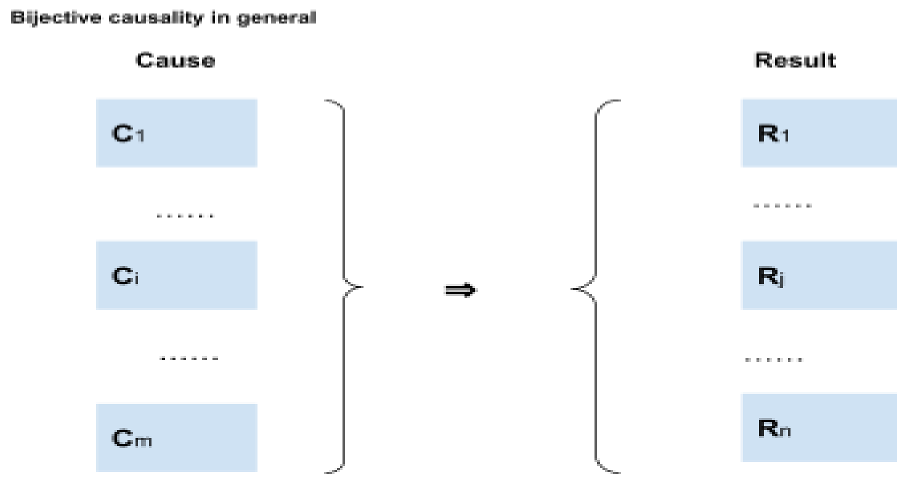
causality Ⅱ



No matter for causality Ⅰ or Ⅱ, It is noted that there is a sufficient and necessary relationship between all causes and all results. For example, in causality Ⅱ, R_1, R_2 covers all the possible results for C_1, C_2 while C_1, C_2 constitutes all the possible causes for R_1, R_2. If viewing a property as a set and any degree of the property as an element of the set, a bijective mapping can be regarded to exist from C_1, C_2 to R_1, R_2. To be specific, any given degree of C_1, C_2 would result in a unique degree of R_1, R_2 while for any degree of R_1, R_2, we can always find a certain degree of C_1, C_2 as the corresponding cause. For convenience, we call such a causality as ‘bijective causality’. For differentiation, we use '⇒’ to represent a bijective causality. Especially, a causality and a bijective causality involving m causes and n results can be simply denoted as m→n and m⇒n.

Now Let us consider how a mathematical equivalence between different physical properties derives from such a bijective causality. For a general bijective causality $C_1, C_2 ... C_m \Rightarrow R_1, R_2 ... R_n$, lowercase c_i, r_j

are denoted as the degree of the cause C_i and result R_j.



In this m⇒n bijective causality, suppose the property C_{i_0} is the measure target property that we want to measure. Given the causality is bijective, any degree of C_{i_0} could be uniquely determined as long as all other m+n-1 properties in the causality are fixed at a certain degree. In other words, any degree c_{i_0} of the measure target property C_{i_0} is uniquely determined by the array $(..., c_i, ..., r_j, ...), i \neq i_0, i = 1, 2, ... m, j = 1, 2, ... n$. But, considering c_{i_0} does not determine an unique array $(..., c_i, ..., r_j, ...)$, we cannot assume a rigorous equivalence between them, which means

$$c_{i_0} \neq \{(..., c_i, ..., r_j, ...), i \neq i_0, i = 1, 2, ... m, j = 1, 2, ... n\}$$

However, if we introduce some mathematical operator(s) to calculate m+n-1 components of $(..., c_i, ..., r_j, ...)$ to a single mathematical result according to the positive or negative relation between c_{i_0} and each component, then c_{i_0} would determine a unique mathematical result. Hence, we can assume a rigorous equivalence below

$$c_{i_0} = \{\otimes\ (..., c_i, ..., r_j, ...), i \neq i_0, i = 1, 2, ... m, j = 1, 2, ... n\} \tag{2}$$

In above, $\otimes\ (x_1, x_2, ... x_s)$ is denoted as the single mathematical result after implementing the mathematical operator(s)$\otimes$ on the array's components $x_1, x_2, ... x_s$.

Due to the arbitrary of c_{i_0}, by going through all degrees of C_{i_0}, we have

$$C_{i_0} = \{\otimes\ (..., C_i, ..., R_j, ...), i \neq i_0, i = 1, 2, ... m, j = 1, 2, ... n \tag{3}$$

Obviously, (3) is the consequence of viewing all m+n-1 causes and results other than C_{i_0} as variables. Here, if, at the start, we select part but not all m+n-1 properties, denoted as$...C_k...R_s...$, and make some constant assumption by fixing each of them to any constant degree $c_k,...r_s$, then by repeating the above process, we have

$$C_{i_0} = \{\otimes\ (...\ c_k,...\ C_p,...,\ R_q,...\ r_s...)\} \tag{4}$$

For (4), by splitting the variable properties and constant properties, we have

$$C_{i_0} = \{\otimes\ (...\ C_p,...,\ R_q,...)\cup(...\ c_k,..\ r_s...)\} \tag{5}$$

For a specific array of constant degrees $c_k,...\ r_s$, according to (1), suppose we can find some phenomenon that satisfies:

$$P\ \approx\bigcap_{k,s}\{C_k = c_k,...,R_s = r_s,...\} \tag{6}$$

and each variable property $C_p,...,R_q$ of this phenomena P have been previously measured, by putting (6) into (5), then

$$C_{i_0} = \{\otimes\ (...\ C_p,...,\ R_q,...) of\ P\ \} \tag{7}$$

In above, $P\ \approx\bigcap_{k,s}\{C_k = c_k,...,R_s = r_s,...\}$

In fact, '$\otimes\ (...\ C_p,...,\ R_q,...) of\ P$ ' can serve as the reference for measuring C_{i_0}. Firstly, for the phenomenon P , $C_p,...,R_q$can be viewed to be previously measured, which means we can reach a consensus on the degree for each of them. Also, the definition of any mathematical operator is comprehensively accepted and agreed by us, so the mathematical result of several previously-measured properties $\otimes\ (...\ C_p,...,\ R_q,...)$ can also make different observers reach a consensus. Besides, any specific phenomena P does not generate any disagreement among different observers because it is impossible for all normal observers to perceive different results on a phenomenon. Therefore, $\otimes\ (...\ C_p,...,\ R_q,...) of\ P$ as a whole reaches a consensus for different observers and hence can serve as the reference for measuring C_{i_0}.

In history, all physical properties can be viewed to be indirectly measured under the frame of (7). Especially, if we view an indirect measure method as a physical law or a physical equation, $C_{i_0}$and $C_p,...,R_q$ are equation's variables and $\bigcap_{k,s}\{C_k = c_k,...,R_s = r_s,...\}$ appears to be some physical constant.

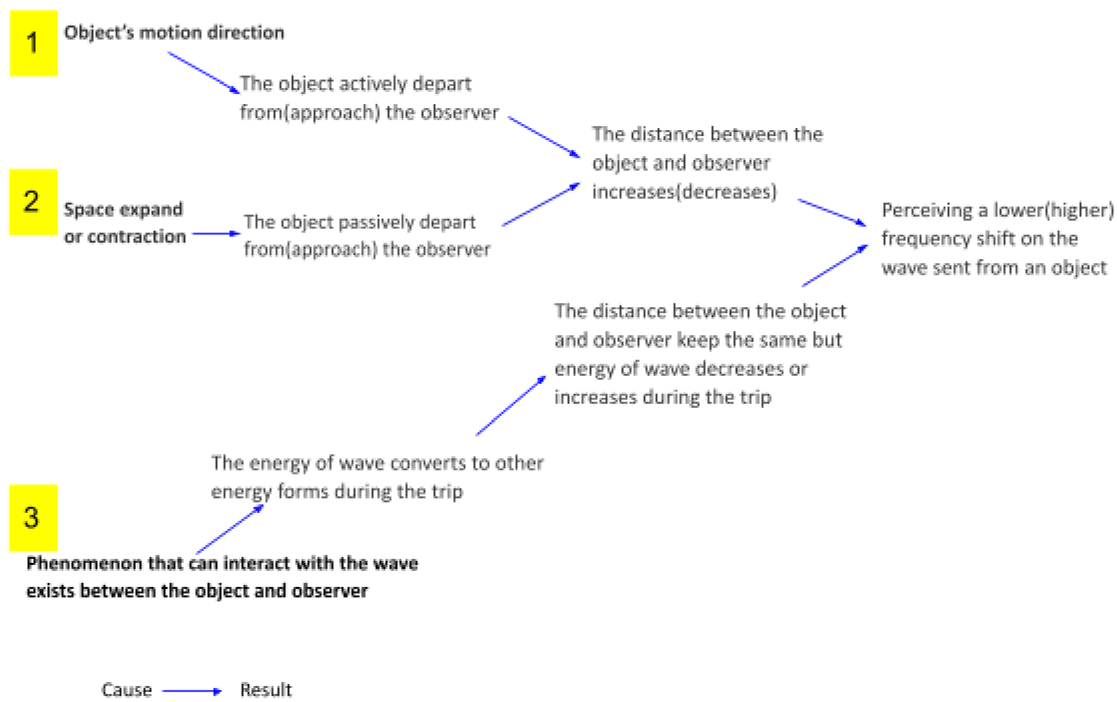
3 The particular principle and limited application range of the Doppler effect

As we know, the Doppler effect measures the object's motion direction based on the casualty below:

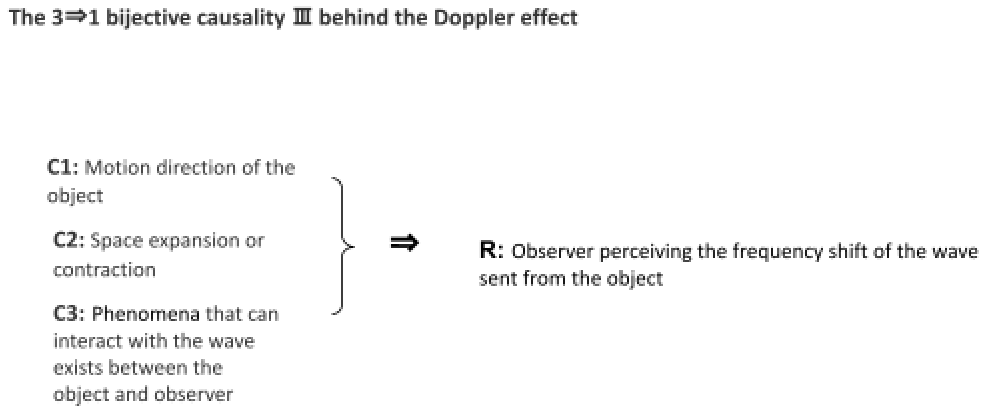
Direction of an object's velocity relative to observer[C]→ Perceiving the frequency shift of some wave sent from the object[R]

Obviously, this is not a bijective causality because there are other possible causes that can also lead to the ultimate result, shown in the below Fig. 1.

Fig. 1. All possible causes for perceiving a frequency shift of wave sent from an object



Considering there are no other relevant results in Fig. 1, the rigorous causality behind the Doppler effect can be described as a 3⇒1 bijective causality, denoted as causality Ⅲ.



According to (7), only if C_2 and C_3 in causality Ⅲ are fixed to a constant degree, we can assume an equivalence between the object's motion direction(C_1) and perceiving the frequency shift of the wave sent from the object(R). In short,

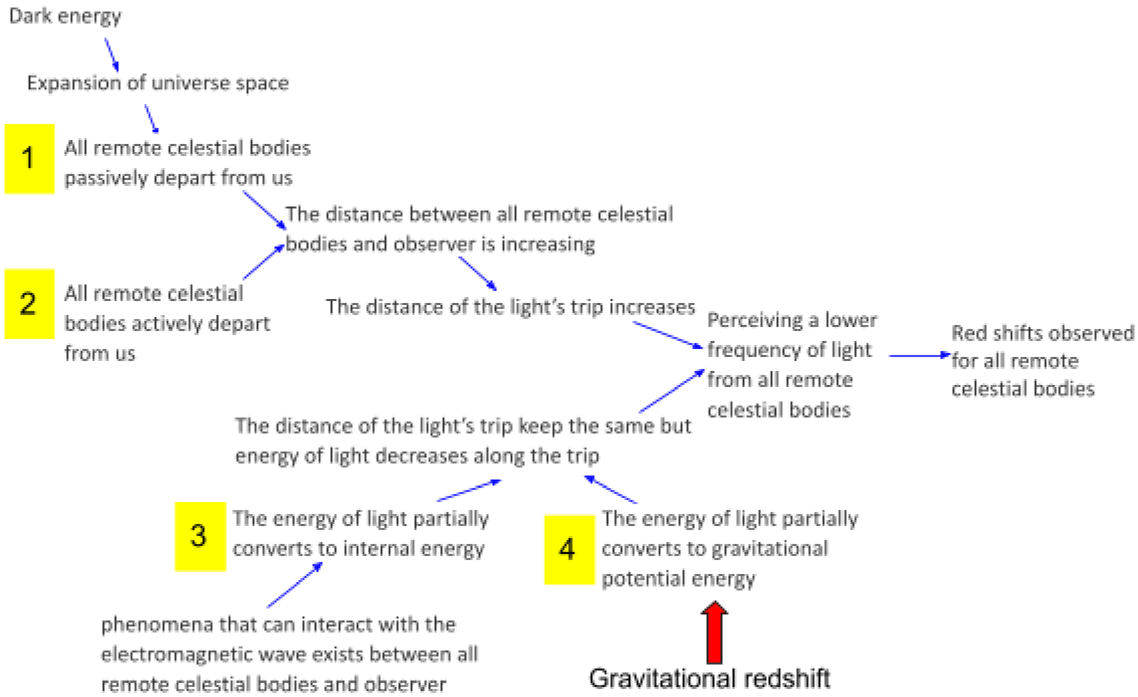
$$\text{Motion direction}[C_1] = \{\otimes\text{Wave's frequency shift}[R] \text{ of } P \approx \{\text{constant}C_2\} \cap \{\text{constant}C_3\}\ \} \tag{8}$$

From (8), the Doppler effect actually describes a bijective causality with a constant assumption for two physical properties C_2 and C_3. According to (7), without the constant assumption, the equivalence between measure target property and reference cannot hold true. Thus, as an idealized hypothesis, the constant assumption actually limits (8) to not hold true for all phenomena but a specific range of those phenomena that satisfy {constantC_2 ∩ constantC_3}. According to the current physical system, the constant degree of C_2 is named as the cosmological constant while the constant degree of C_3, especially the zero-degree constant C_3, which can be viewed as the phenomena that cannot interact with the wave, is exactly the definition of dark energy if we only consider the situation of the electromagnetic wave. In the following, we can see this is not a coincidence because only defining 'dark energy' in such a way can force the Doppler effect valid for all phenomena in the universe. However, such an 'amending-reality' manipulation is merely logical-valid but not factual-valid because something that does not belong to reality is assumed to exist.

4 From the limited application range of Doppler effect to review the whole logic behind how we conclude the cosmic accelerating expansion

Considering the conclusion of the cosmic accelerating expansion originates from the observation in remote celestial bodies rather than the nearby ones, let us firstly compare the difference between the phenomenon's particularity of nearby and remote celestial bodies. For the sun or any planets in the solar system, there is obviously no discrepancy between the Doppler effect and gravity theory on them. On the one hand, the red shift observed from them is so subtle that we can ignore it. On the other hand, the sun or any planets in the solar system are not accelerating to depart from us but moving under the gravity theory. The discrepancy between the Doppler effect and gravity theory only occurs on those remote celestial bodies. According to the Doppler effect, the comprehensive red shift represents that remote celestial bodies are accelerating to depart from us, which is contradicted with any gravity theory. According to (8), if we only consider the situation of the electromagnetic wave, one application range restricted by the constant assumption for the Doppler effect can be described as 'all phenomena existing along the way between the object and the observer do not interact with the electromagnetic wave'. Obviously, this application range is so narrow that it can only apply to very few objects, e.g the observed object is not far away from the observer so that there is no interference during the wave's trip. However, remote celestial bodies just implies the inevitable existence of other phenomena that could interact with the electromagnetic wave during the wave's trip. In other words, the phenomena of remote celestial bodies actually exceeds the application range of the Doppler effect. Hence, even if we could observe red shift for all remote celestial bodies, it cannot illustrate that they are departing from us due to the existence of other possible causes, shown in Fig. 2 below.

Fig. 2. All possible causes for the comprehensive redshift for remote celestial bodies



From Fig. 2, we can see that unverified dark energy is nothing but logically-needed for one of four possible causes. Considering remote celestial bodies have no reason to actively depart from us, we can simply exclude the 2nd possible cause and hence there are only three possible paths of 1,3,4. On the one hand, the possibility of the 4th path has been proven[*1*]. On the other hand, the reasonability in the 3rd one is so obvious that we do not even need to make any further illustration. Thus, given the 3rd and 4th paths are more reasonable for explaining the ultimate result of comprehensive red shift, the existence of dark energy is unnecessary. Moreover, Hubble's law can also be more easily understood in this view. For the remote galaxies that are farther away from us, there are more phenomena that can absorb, radiate or reflect the electromagnetic wave along the way between the observed galaxy and the observer. Hence, it is not strange that the redshift is more obvious for the galaxies that are farther away from us.

Today, although the current physical system admits the existence of the 4th possible cause, it still makes great efforts to support the 1st possible cause by excluding the 3rd possible cause. Logically speaking, if we assume that the universe has an extremely large proportion of 'something' that cannot interact with the electromagnetic wave, each light from any remote celestial body can be approximately regarded to travel into the observers' sensor without any influence during the trip. To realize this purpose, it is better to assume that not only dark energy makes up a high proportion of the universe's total energy, but dark matter also cannot interact with the electromagnetic wave. Based on such an artificial hypothesis, the whole universe becomes an ideal space that is flooded with something that can logically exclude the possibility of the 3rd cause. Given the red shift caused by the 4th cause is limited, the reason for large-scale redshift can only be attributed to the 1st cause. However, although such a manipulation is logically valid, reality is not only forcely added to something that does not belong to it, but some secondary contradictions can also be generated. A typical secondary contradiction is that if the 1st cause is viewed as the main reason, an accelerating expanding universe would become the only explanation for 'why redshift is more obvious for the galaxies that are farther away from us'. In this view, the universe would inevitably be in a superluminal expanding process. To explain such an irrational result, we need to introduce more extra hypotheses into reality, such as the expansion-and-contraction of space being different from the motion of the phenomena.

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