

THE RELATIVE VELOCITY OF LIGHT

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It is rather difficult for those who do not specialize in physical science to understand Relativity Theory. To summarize, Einstein proved that mass and energy could be interchanged in the formula $E = m.c^2$ (in which E: energy, m: mass and c: velocity of light). Once an object moves nearly as fast as light, its mass increases, the surrounding gravitational field increases, space simultaneously shrinks and the time passes more slowly. An example of the slow passage of time: In a fixed frame centered on earth, a time period of 100 years, would be equivalent to one year on a spaceship moving at nearly the velocity of light.

In Vietnamese folklore, a young man named Tu Thuc unintentionally rescues a girl-embodied fairy walking on earth. Admiring greatly his kindness, the fairy invites him to visit her paradise. Living for only 3 years on the paradise, Tu Thuc, in his homesickness, asks to return to the earth. Arriving to his homeland, everything has been changed, 80 years have passed and his relatives and friends have died long before. His offspring and the old persons of the village do not know him. In their memory, if great-grandfather Tu Thuc was alive, he would be over 100 years old rather than a young man of twenty.

Relativity Theory has been experimentally proven. The term "relativity" is used because all elements such as mass, space and time are only relative and only light velocity is absolute. It represents a limit for all velocities, at approximately 300,000km/s. Thanks to its absolute aspect, light velocity is used to measure distances in the universe, i.e. distance that light travels in a year. Why is everything relative except light velocity? Is it true that light velocity is a constant anywhere in the universe? Is light velocity absolute in a frame but only relative if compared to other frames? It is very necessary to address these critical questions in science. Otherwise a small mistake can regrettably delay historical development. Within such a small article, it is impossible to address the wide range of critical works, only generalized hypotheses are set forth. If we were brilliant and fair judges, we would not dare to decide who is right or wrong regarding light velocity.

Firstly we have to understand Newton's first law on inertial reference frames: that physical rules in a fixed frame are equivalent to those in a moving frame. Later Einstein used this postulate for frames in uniform motion that approach the velocity of light.

The change of a planet's mass is equivalent to the motion of a planet with extreme velocity so that its mass, space and time are changed. We find the planet is moving or the distance from earth to the planet is changed by the change of planet's space and time. But the change of planet's space and time makes us to see virtual images. In fact the planet is not moving and the distance from earth to planet is unchanged. That is why Einstein said that same thing is larger or smaller, depending on the position of the observer. Being on the earth, you find distance from earth to planet is smaller than original position, but being on the planet you find this distance is larger than the original position.

So I want to say that the planet is not moving and it is still in such position. Only light signal is moving. On distance from earth to planet, light velocity is changed, but everyone at the earth always think that light velocity is unchanged, so they find the planet is moving though in truth it is not moving. Everything in the universe they see which are truth for them, but which are virtual image for other man and vice versa, and the nature of space, time and light velocity are very complicated.

We assume that our Earth is a fixed frame and a planet whose mass, space and time are like our Earth, is situated 30,000,000km distant. On Earth, a beam of light is directed toward the planet and reflected back to Earth. The time for the light beam to return to the Earth is measured. Of course, the round trip is $t = 2 \times l/v$ (in which v : velocity of light = 300,000km/s; l : distance from Earth; t : time of the round trip).

$$t = 2 \times \frac{l}{v} = 2 \times \frac{30,000,000km}{300,000km/s} = 200s$$

Time for the round trip of the light beam is 200s. The distance between Earth and the planet remains 30,000,000k. Given the planet is still in such a position, the distance is unchanged but its mass decreases significantly. The decreased mass makes the time pass 10 times faster than on Earth. From the Earth we turn on the beam to the planet and gauge how long it takes from Earth to the planet and vice versa. The light beams depart from Earth with a constant velocity of 300,000km/s. However in proximity to the planet, the velocity is reduced, possibly at first entering into the gravitational field of the planet, or we may suppose a velocity reduction at the middle distance from Earth to the planet so that the question is less complicated. You should remember that time passage on the planet is 10 times faster than on Earth. The light velocity is also reduced 10 times accordingly. It is no longer 300,000km/s but only 30,000km/s as compared to the Earth (the velocity of 30,000km/s as compared to the passing time of the Earth is equal to 300,000km/s as compared to that passed on the planet). On travelling 30,000,000km, the light velocity to the planet is decreased by 10 times, giving a time for roundtrip of the light beams at:

$$t = 2 \times \frac{l}{v} = 2 \times \left(\frac{15,000,000km}{300,000km/s} + \frac{15,000,000km}{30,000km/s} \right) = 1,100s$$

It is taken for granted that the light velocity is unchanged at 300,000km/s, thus the distance from the Earth to the planet will be $2l = v \times t \rightarrow l = (v \times t) : 2$

$$l = \frac{300,000km / s \times 1,100s}{2} = 165,000,000km$$

But not 30,000,000km in the case where the planet has as an equal space and the time frame as Earth. We realize that the planet is further than the original position when the mass has not been decreased: $165,000,000km - 30,000,000km = 135,000,000km$.

On the contrary hypothesis, the planet's mass is increased so that time passing on the planet is 10 times slower. (This is absolutely right because the planet's mass is equal to mass of the fast moving frame, with time passing 10 times slower than the Earth. Otherwise in the case of not being equal, is it possible that the mass but not gravitational force is equal?). Ten days pass on the Earth but only one day on the planet. In such a case, the light velocity from the Earth to the planet is increased by 10 times. It is no longer 300,000km/s but 3,000,000km/s calculated based on earth time. Such velocity increase is for ascertaining that the light velocity on the planet is always 300,000km/s measured in the time passing on the planet. The gauge on the Earth is taken to measure the time of a return trip by the light beam. The light velocity to the planet is increased by 10 times, given in the mid point of travel. Roundtrip time of the light is $t = 2 \times l/v$:

$$t = 2 \times \frac{15,000,000km}{300,000km / s} + 2 \times \frac{15,000,000km}{3,000,000km / s} = 110s$$

On Earth we know the time of a round trip for light and ascertain that it is transmitted with a constant velocity of 300,000km/s. The distance from the Earth to the planet is calculated with the actually measured time of the roundtrip of 110s. It is:

$$l = \frac{v \times t}{2} = \frac{300,000km / s \times 110s}{2} = 16,500,000km$$

But not 30,000,000km in case the planet does not have a different passage of time as compared to Earth. People on the Earth realize that the planet is nearer than its original position: $30,000,000km - 16,500,000 km = 13,500,000km$.

At the first glance on the above mentioned samples, we have to utter: how illogical it is! How "mad" it is! How can the light velocity know "when in Rome, do as the Romans do" to maintain a constant of 300,000km/s in all directions at the time of entering the system? If we think it over, it is not illogical or "mad". Because when creating Relativity Theory, Einstein imagined the light velocity was unchanged in all direction for any reference frame and was 300,000km/s, however he did not indicate in which reference frame the "s", so-called *time* belonged. Is it of the fixed or moving reference frame that causes increased mass, expanded space and slowed time? It is confirmed in Relativity Theory that light velocity is constant and equal to

300,000km/s transmitted in all directions and always right in all inertial reference frames.

If the light velocity did not know "when in Rome, do as the Romans do" when entering a space or time where the time passes faster or slower than ours, at such an inertia reference frame, will the measured light velocity be 3,000,000km/s or only 30,000km/s but not 300,000km/s as usually calculated there? This is just illogical and unacceptable. If so all physical rules of inertial reference frames are upset and Newton's first law and even the Relativity Theory are in vain. Simply, light velocity's physical factors in reference frames are not alike.

In early 2004, NASA launched a spaceship to test the Theory of Relativity. The result was doubtful, but the light velocity could certainly be 300,000km/s as per the time of the spaceship since it was equal to the inertia reference frame. If so, after 100 years, humans can understand well and fully Einstein's Relativity Theory and answer whether light velocity is relative or absolute and a new historic page of modern physical science can be opened.

RELATIVITY THEORY: A GREAT CREATION BY EINSTEIN

In 2005, mankind celebrated the 100th birthday anniversary of the Relativity Theory and the 50th anniversary of the death of Albert Einstein, the great scholar of the XX century, who has changed human's awareness of the natural world and significantly contributed to the development of human knowledge.

We wonder what such anniversaries tell us. Is it to read about his biography, then to set forth generalization on the birth of the Relativity Theory? In fact we have not understood the great and intensive meaning of the theory. For understanding thorough, we have to believe that such a solemn anniversary is the date when physical science will turn over a new page, and the human awareness will be again extended. Thus there is great merit in Einstein's contribution to humankind.

Why has the mankind not understood thoroughly the deep meaning of the Relativity Theory? If you immediately understand it, you will comprehend the nature of the space and the time and which principle creates the close relation between them. You will understand the complexity of the universe and believe the hypothesis that the universe is formed in a Big Bang explosion, from which its age is calculated to be 13.7 billion of year. It is a very regrettable thing.

Before the past century, we said that space and the time were closely related physical factors, not shrunk or expanded as time passed slower or faster. Einstein is the very person who directs us to such acknowledgement. But why does time change after changed space? No one can answer this question, except Einstein. What is the nature of space? That is a difficult question since nobody sees or touches space, however it is not an absolute vacuum. It is not empty space without anything or meaningless nil space without physical value. Space is therefore understood relatively, as a metaphysical energy field with a temperature of 2.75°K (it is called metaphysical since space is an unshaped specific energy field in human awareness). When studying and concluding that Relativity Theory is right, we should have understood that if space is shrunk or expanded by a great or small

gravitational force, it is not an empty or absolute vacuum. If it were empty space, how can it shrink or extend?

This is how the space is understood. What about the time? It is a physical factor for which we know that it passes from the past, the present, then to the future regularly and stably. Things that are happening are the present, ones that happened are the past and ones that are going to happen are the future. It is impossible to reverse what happened or to hope to see what is going to happen. We agree by consent that time measurement units repeat on a rotating cycle of the earth, are called day-night and divided into 24 hours. Then one hour is sub-divided into 60 minutes and one minute into 60 seconds. The most basic measurement unit is the second whose symbol is "s". In order to illustrate the fast or slow passage of the time, we monitor simple digital information models. For example in nature, the human body's apparatus is very sophisticated and is a very precise watch. Our brain is familiar with processing information through the eyes with an image's existence on the retina in the time velocity of 24 image/s. If a film is projected with 40 image/s, we immediately realize faster time and velocity of projecting than usual. On the contrary, if the camera projects with 10 image/s, we can realize slower ones. Otherwise if it is only 1 or 2 image/s, it is likely that time is passing too slow and that the machine is idle. In applicable physics, archaeologists calculate time by measuring semi-degeneration cycles of carbon radio-active isotopes. Those are insentient materials reflecting time development in natural space, not depending on any reason. For example, there is a specimen that is divided into two equal parts. One is placed on the earth, the other in a frame with slowly passing time, such as black hole. After a long period, the two parts are compared and the scientists determine that they do not have the same age.

Fast or slow passage of the time between different frames of reference is no longer difficult for human understanding, and rightly comprehending its principle is not too difficult. The great discovery by Einstein is that mass and energy is inter-transformed, thus radiation speed of material mass must relate to radiation speed of energy when both are in the same frame. As above mentioned, space is an energy field but not empty space, thus the electromagnetic radiation speed in space also is of a material amount in the entire frame. This is also very easy for understanding a feature that few persons recognized: time passing is dependent on the electromagnetic radiation speed in space. If electromagnetic radiation is fast, time passes fast; if electromagnetic radiation is slow, the time passes slowly. The electromagnetic radiation speed is of various kinds of waves in the space, one of which is light. The close relation between space and time has been revealed, that is through light's velocity in the space. From time to time, it is very simple but we often complicate it so we can not believe though it is an objective truth. Seeing a falling apple, Newton suddenly recognized gravitational force in space, the fact seemed so complicated that it was impossible to realize such an invisible force. However it turned out to be simple. That is an essential lesson in the way to derive the rules of the natural world by physical scientists.

For a frame of reference, the space is shrunk or expanded, i.e. the electromagnetic field changes, the electromagnetic radiation of total energy and material mass in the frame is slower or faster and accordingly, time passes slow or fast. Thus three

physical factors (a space, a time a light velocity) in a reference system are closely related and incorporated parts. That we have recognized so far two physical factors - space and the time, which are closely related is quite wrong and needs to be rejected. Otherwise science will lead to a standstill and it will be impossible to understand the rules of the natural world. The direction of research is diverted and, of course, Relativity Theory is not comprehended.

Maybe habits restrict the human's creativeness. It has been accepted that light velocity transmitted in space is a constant of 300,000km/s, and has been proven many times in fact. However we "forget" that we measure and observe it right at our own reference frame, we then see it partially but not wholly within our location. In space there are many different frames of reference where the space and the time pass differently from ours, for instance the space and the time of a black hole. No scientist dare say that the space of the black hole is like one of the earth and time passing through the black hole is similar with Earth. Different position of observers make different results, This is the lesson that Relativity Theory taught us. It is impossible to accept the statement, that when light enters a black hole its velocity remains at 300,000km/s. We wonder from which frame of reference the light velocity in a black hole is calculated. Is it in the reference frame of the black hole or another where our earth belongs? Most of us acknowledge that, of course, it is calculated as per the time in our reference frame and such velocity is absolutely right in the entire universe. If so, given the passage of time in a black hole reference frame, light velocity is extremely slow, possibly at zero km/s. Otherwise it must accept a fierce truth: light velocity is 300,000km/s calculated in the passage of time of the black hole. In an absolute comparison and given the light velocity on the earth as standard, the light velocity in a black hole may be billions of km/s, even it is indefinite. We should acknowledge that the physical factor to measure the time passing at different frame of reference is not redundant. Detecting time passage in such a reference frame where the space is shrunk or expanded is not a joke. Otherwise we have to accept the statement: light velocity is a constant and equal to 300,000km/s in all reference frames and calculated as per the time passage in such a frame. Or we have to deny the first law of Newton on the identity among inertia reference frames and the similarity rule between a fixed and moving frame that has great velocity so that space shrinks and time passes slower. Since light velocity is not equal in different reference frames, how does the reference frame with light velocity of 300,000km/s correspond to one with light velocity of 3 billion km/s or 300km/s? Are we wrong, or is Newton and Einstein wrong? It is impossible that Newton and Einstein are in error, but only us who do not know how to understand the great ideas of such great persons.

The 100th anniversary of Relativity Theory is a very historic turning point in changing cosmography. In order to prove it, we provide a sample like Einstein's Relativity Theory.

For example, we dispatch a group of scientists on board an airship to fly into the universe to test the transmission velocity of light. This airship can enter into any reference frame where passing time differs from ours, even in a mysterious black hole. The scientists measure light velocity strictly and objectively in every

reference frame. It is a surprise that the results are the same, giving a constant light velocity of 300,000km/s. Their gauges and devices are in good operation condition and free from error. It is an obvious truth that as time changes, any thing in the frame, including the time gauge is also changed. This is the similarity rule between fixed and moving frames of reference of Newton and Einstein (Newton with slow velocity and Einstein with fast velocity that causes space shrinkage and the slow passage of time). And these are what we have repeated above that these three physical factors are closely related. After their space travel for re-inspecting the light velocity in the universe, the scientists return to the earth. They hold a press meeting and announce that light velocity is a constant and equal to 300,000km/s in the entire universe, correct in all reference frames. Space is not shrunk or expanded and time does not pass fast or slow anywhere.

However scientists who sit on the earth, monitor closely the space test of light velocity. They understand Einstein's theorems and have seriously thought about the reference frames of great mass that makes space shrink and the time pass slower than the time on the earth. They say that the scientists on the airship are cheated by "nature". In reference frame A, time passes much slower than the time passing on the earth, the measurement gauge and even their life-span are passing slowly but they do not realize it. Their testing results are quite contrary. They say that time is not changed anywhere but it is obvious that the time reference frame pass slowly, especially in a black hole. They say that light velocity is always 300,000km/s anywhere but the measurement gauge they take has been slowed in their reference frame. So such measurements of light velocity are not right....

In your opinion, are the scientists on the airship or the scientists on the earth right? Both are not wrong as they rightly recognize things on their position of observation and neither can deny the other. It is lack of a comprehensive view if both are self-opinionated and think oneself is right and the other is wrong.

NASA scientists believe in the theory of a BIG BANG explosion and calculate the universe's age at 13.7 billion years. They think that they understand the Relativity Theory but consider light velocity of 300,000km/s as constant and the maximum velocity in the entire universe. It is essential that the universe has a limit at a maximum radius of 13.7 billion light years. Early in 2004, a galactic circle was detected at 13.2 billion light years from earth. The universe's maximum radius and the distance from the galactic circle to the earth are approximately equal, so is the earth in the center or edge of the universe? In order to avoid mistakes it is alleged the geometry of space and therefore the trajectory of light is curved. But the curve and its nature have not been imaged and understood well. They are regarded as an inconsistency of space and time in the Relativity Theory in order to show the impossibility of determining the center or edge of the universe or which happened first or later or that seeing deeply into the universe means seeing the past! In accordance with the latest information in November 2004 astronomers just detected a very young galactic circle that is 45 million light years from earth and most noticeable is that it lies on the edge of the universe. How can we know that such young galactic circle is at the edge? We are inconsistent in our statements and thoughts. Given a variable space and time, how can we determine the age of the universe? How can we determine the distance between galactic circles and the

earth? If this can be done, it is right say that that the age of universe is 13.7 billion years. Otherwise, it is impossible to determine the age of the universe. Is it right say that the young galactic circle is at an edge or center of the universe? There is something strange in the lack of generalization allowing events that happen in the universe to become a muddle and full of discrepancies. Have we not properly understood the Relativity Theory? If light velocity is calculated in a certain reference frame, the view of the universe will rely on others and we will immediately understand the instability of space and time.

Given a light velocity of 300,000km/s in all reference frames relative to their own time and not on our specific time on earth, and recognizing that there are many reference frames with different space and time frames, the universe will be constituted of n different frames of space and time. Corresponding to n frames of time and space is n velocities of light transmission. It is impossible to determine sizes, boundary and quantity of specific reference frames and the age of the entire universe. It is also impossible to determine the size, boundary and age of each reference frame. Like other scientists who travel through the universe in the time and space frames different to ones on the earth, even in a black hole, they can not distinguish that they are entering into that black hole. That the three physical factors: the space, the light velocity and the time, are closely related, makes it impossible to distinguish the difference between reference frames. One can not exist simultaneously in two different reference frames to compare the difference between the physical factors of the two frames. In fact that we can not prove one reference frame differs from another or recognize the existence of various different reference frames in the universe. That is why we easily mistaken to think that universal space is homogeneous and the universe has only our reference frame. The most miserable thing is that we are likely to believe light velocity is the only constant because it is proven right in all cases tested in the whole universe. In fact universal space is not homogeneous and our frame is not the only one. There are many different reference frames aligned as per a certain rule, they may be in series or alternated and our reference frame is only a small one. It is regrettable that most of people do not have the knowledge to recognize this.

We do believe in the BIG BANG theory that says many galaxies in the universe are faster and faster moving away from the earth. This is determined by Hubble's rule and of the red-shift of light. Nowadays it can be explained that there is no expansion in the universe, galaxies are within various reference frames whose time and space differ to ours. These reference frames also cause Hubble's effects and reflect the reason why galaxies move unevenly, but they must be correlative in design.

Not witnessing or not being able to prove by experiment, but we can evaluate it in theory, so the more we study the work of Einstein, the more we recognize his great intelligence that takes us to the threshold of tangibility and metaphysics. Talking about the metaphysical things that co-exist with the tangible things makes everybody believe in the theory.

Einstein often quoted: Science is impaired without religion which is blind without science. Religion should be understood as belief in spiritual awareness. Spirit can

be illustrated as awareness of something metaphysical, invisible or untouchable apart from the tangible material world that can be proved in fact. Those who only believe in the spiritual world but do not master science can not conceive anything and may misunderstand the natural world. Nevertheless, science only believes in what can be proven and tested within reality, but do not accept superior physical theories that indicate the existence of different reference frames in the universe which can not be proven. So our knowledge is restricted and one-sided.

The most outstanding question in the XXI century is whether light velocity absolute or relative? Maybe nobody believes it is true that resolving this question will be a historic turning point in the modern physical science which will prove that the humankind can comprehend the great value of Relativity Theory.

The 100th birthday of Relativity Theory and the 50th anniversary of the death of Einstein are an opportunity to extend scientific creativeness and independent thinking by each person in the XXI century. It is also an opportunity to address and to solve outstanding obstacles in Relativity Theory so that scientists regardless of race and nationality can come together to discuss and research and clarify its value toward the development of humankind.

Hanoi , 2005. Written by Le Van Cuong.