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A DISCUSSION ABOUT THE NATURE OF TIME

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Abstract:

This article discusses the nature of time. The great Einstein once said: "time is an illusion". This article humbly says: time is not an illusion, time is an impression. Time is actually a parameter used to describe the relative rate change of the universe. Detailed discussion shows what time dilations actually indicate if time dilations really exist. This article also discusses Einstein's elevator experiment.

Key Words: Special Relativity, Theory of Relativity, Albert Einstein, Theoretical Physics, Time, Space Time

Main Text:

Time, as a basic concept of physics and general science, is hard to define. But actually, its nature is apparent. It is about change. It can be the change of physical state of matter, it can be the change of the structure of an object, it can be the change of material properties, it can be the change of an object's position in the space (the moving of an object), it can be the change of life stages of a creature (the growing of a creature), it can be the building of house, it can be the making of an instrument, it can be the evolution of species, it can be the development of technologies, it can be the propagation of electromagnetic radiation, it can be the merger of black holes, etc.

So the nature of time is about change. This is actually obvious because, if the entire universe doesn't change, the concept of time has no meaning.

For every physical concept or physical parameter, we need to measure it and we can measure it. For time, the measuring of it can be by using a watch, or a clock, or an atomic clock, etc.

So, if nothing changes inside universe, the hands of a watch will not move, the clock will not tick, and the electromagnetic radiation will not happen in atomic clock, so the time is static, meaning there is no change in the universe at all. And it is also true that we human beings are less capable of measuring or noticing any change in the universe than our equipment's, so if all our equipment's are not able to detect any change in the universe, we human beings will not notice anything changing at all.

What does this mean? This means, if all matter in the universe stops to change, we will not be able to know about it. This means, if our universe suddenly stops to change, we don't know that the universe suddenly stops to change. There is no way for us to know about any stop of change of the universe. We used to believe that time never stops, we were convinced that time is always going forward, but now we can see, we don't know. We have no possible way to exclude the possibility that time can stop. It is theoretically possible that time may not be always going forward continuously.

Suppose, now that our universe has evolved for 13.79 billion years, then, from now on, the universe stops to change (the time of the universe stops) for 10 billion years, and then the universe start to change again (the time of the universe resumes to go on), we will never know that the universe has stopped to change for 10 billion years. Thus there is no proof to say: the time always go on at the same rate. It is theoretically possible that time stops to go on and then resume going on. It's only that we cannot notice it. So we can say at any time "the universe has just entirely stopped to change for 10 billion years", and no one can prove that you are wrong.

It was also believed that time can only go forward and cannot go backward. But actually, in theory, it is possible that time is going backward. If time goes in the reverse direction, we cannot notice it. If we human being were born from grave and start our life as a very old man, and we become younger each second, and our memories are deleted bit by bit each second, and all the laws of physics are running backward, we will not know about it. We now take it for granted that we put raw rice into a rice cooker and supply heat and after 30min, the rice will be cooked. But, in a reverse universe, we may take it for granted that we put cooked rice into a rice cooker and take heat out of it and then after 30min, we take raw rice out of the rice cooker. But it should also be pointed out that, even if time, as a whole, can run backwards, it doesn't have any practical meaning on our actual life. It is just that, theoretically, it is possible that time can run backward. Or we can put it this way: for our current world, we have no way to find out whether time as a whole is running forward or backward.

Thus it is also possible that time is running back and forth again and again without we being able to know anything about it.

Also, theoretically, time may go on not continuously but jump ahead (or backward as we discussed). It is possible that time is not continuous (the status of some existence can only be "before the change" or "after the change").

It is also true that it is possible that time can, at a certain point, start to go on at a faster or slower rate (the universe can change faster or slower), but if the time changes its passing speed as a whole, there is no way we can detect or notice it. But if the time for something (or in some part of the universe) becomes faster or slower than other things (or in some other parts of the universe), we will be able to detect it.

Here, it seems that we are talking about the time dilation of the theory of relativity? Actually, no. The thing about time dilation of theory of relativity is: for example, when a spaceship is about to enter into a black hole, according to the theory of relativity, the time on the spaceship will be influenced by the extreme gravity of the black hole and will stop(or almost stop, because it will take forever for the spaceship to completely stop).

But if time stops (or almost stops) near the black hole, certainly the spaceship will never enter into the black hole. If this is true, when two black holes begin to merge, each black hole is very near to the other black hole and the time for each black hole will stop (or almost stop) , so the two black holes will never merge. This is apparently not true because we have already observed many incidents of black holes merging together. So we can say that the time dilation, according to general relativity, caused by gravity is false. Time does not stop even when gravity is extremely high.

(Actually, regarding general relativity, there is also a basic flaw about Einstein's elevator experiment: the observer inside the elevator can easily decide whether the elevator room is stationary in a gravitational field or in free space aboard a rocket that is accelerating at a rate equal to that of the gravitational field, and there is an apparent observable distinction between inertial motion and motion under the influence of the gravitational force: for the motion under the influence of the gravitational force, the moving object is stretched because different parts of the object receive different levels of gravitational pull inside the gravitational fields, while for inertial motion, the moving object is not stretched but stays as a whole. This stretching may not be easily noticeable by human experience, but as a physics topic, the stretching caused by gravitational fields is practically existent. If we insist to use the method of mapping the trajectory of bodies such as a dropped ball, it is also ok. We just need to drop not one ball but several balls at different levels inside the elevator room (we might need to imagine a VERY TALL elevator room to ensure that the difference is obvious). It is apparent that inside the static elevator room, the balls dropped at lower level are nearer to the source of gravity and are thus in a stronger gravitational fields than the balls dropped at higher levels. Thus the trajectories are different. But inside the rocket accelerating in free space, the balls dropped at different levels will have the same trajectories.)

But there are also many evidence proving that time dilation caused by gravity is true. For example, repeated experiments show that atomic clocks run at different speeds when the strength of gravity field is different.

Why?

Let's study closely.

Here, when we say the time on the spaceship will stop(or almost stop), what does it mean?

a) Does it mean that the growing speed of a plant on this spaceship is zero (or almost zero) and the plant will stop(or almost stop) growing? Or
b) Does it mean that the spaceship will stop entering into the black hole? (Or we describe it another way: does it mean that travelling speed of the spaceship will become extremely slow that it will take billions of billions of billions of years(forever) before entering into the black hole?)

Apparently, it cannot be (b), it can only possibly be (a), if time dilation exists at all.

Thus, at least, the "time dilation" indicating "the travelling speed of an object will be near to zero because of extreme gravity" is not true. And the "time dilation" indicating "the growing speed of a plant (or the running speed of an atomic clock) on a spaceship will be near zero because of extreme gravity" could be true but it needs to be further studied. For example, it could be possible that stronger gravitational field will cause speed of the electromagnetic interaction (and/or other kind(s) of fundamental interaction(s)) to generally slow down. But it is not possible that stronger gravitational field will cause moving objects' moving speed to generally slow down in all moving directions.

To sum up:

If: it is true that atomic clock runs more slowly in stronger gravitational field, and it is true that we have observed many cosmic events of black holes merging together,

Then: It can be true that stronger gravitational field will cause speed of the electromagnetic interaction (or other kind of fundamental interaction) to generally slow down,

But: It can't be true that stronger gravitational field will cause an object's moving speed to generally slow down as indicated by time dilation according to general relativity.

Thus: The time dilation caused by gravitational field is not really a time dilation but actually only indicates that gravitational field has influences on the speed of electromagnetic interaction (and/or other kind(s) of fundamental interaction(s)).

For the time dilation according to special relativity, it is the same. If it is true that the atomic clock runs slower when travelling at higher speed, it can be true that higher travelling speed will cause speed of the electromagnetic interaction(and/or other kind of fundamental interaction) to generally slow down(if this is true,

this does provide an explanation, other than theory of relativity, why particles can never be accelerated to the speed of light: because we use electromagnetic interaction to accelerate particles, if higher moving speed causes electromagnetic interaction to slow down and, when particle's speed is near to speed of light, the electromagnetic interaction used to accelerate particles will nearly stop, then particles can never be accelerated to the speed of light. And if this is true, our rockets which use chemical fuel also can never be accelerated to the speed of light because burning chemical fuel is actually electromagnetic interaction. As the speeds of rockets increase, the speed of the chemical reaction of burning of the fuel, which is actually electromagnetic interaction, will decrease, so less energy will be generated. And when the speeds of rockets are near to the speed of light, almost zero energy will be generated to push the rockets. Thus rockets will never reach the speed of light. Even if we use not chemical fuel but nuclear fuel or even antimatter fuel to push the rockets, the pushing/pressuring force on the rockets is still realized by electromagnetic interaction. In addition, as said, other kinds of fundamental interactions may also be influenced by travelling speeds so the speed of burning nuclear fuel or antimatter fuel can also decrease due to the increase of rockets' moving speeds, but this needs to be studied in the future). But it is not possible that higher travelling speed will cause an object's time generally slowing down which indicates that its moving speed also generally slows down.

For example, if a spaceship is flying at the speed of 99% light speed, according to special relativity, its time dilation is about 7, as compared with the observer on the earth. Thus, everything actually happening on this spaceship will be 7 times faster than as observed by the observer on the earth. According to the observer on the earth, the spaceship is travelling at the speed of 99% light speed, so actually it is travelling at the speed 7*99%=6.93 times light speed? Of course not. Thus it is sure that high speed does not cause time dilation in the sense that spaceship's moving speed is slowed down.

(Although this article concludes that the time dilation according to the theory of relativity is not true (and probabaly the theory of relativity is not true. Then ether should exist? If so, the so-called ether should be gravitational fields. This is logical because it is known to all that vacuum gravitational fields, in which light can travel, can interact with electromagnetic wave and can bend light, as transparent crystal, in which light can also travel, can also interact with electromagnetic wave. That's why, when we measure light speed on the surface of the earth, the light speeds are the same in every direction, because light travels at the same speed in the same gravitational fields), we must still recognize the greatness of Einstain and the enormous value of his theories. The greatness of Einstain and his immortal contributions to human technological progress will forever be worshipped and remembered during the entire history of science.)

Up to here, we know that time can have different indications. Time is not a universal concept. There can be at least two times: the time describing the travelling speed of an object and the time describing the speed of electromagnetic interaction.

Thus laws of physics involving the parameter of time (t) will need to be specific about which time does it mean. Time as written by "t" in all scientific equations are convenient for calculations and many useful results are deducted thanks to it in previous history, but time has an actual meaning: speed of changing. The relative changing speeds of different matter (change of its position and change of its status, etc) give us the impression of time. But time is not an fundamental property of universe, change is. Inside the universe, changes are constantly happening. And each change has a speed. Relative to each other, some changes are faster, some changes are slower. This gives people the impression of time. The great Einstain once said: "time is an illusion". The author humbly says here: time is not an illusion, time is an impression. Time is actually a parameter used to describe the relative rate change of the universe. And all laws of physics will not be against this.

Thus, as one of the base units of the International System of Units (which are the meter, kilogram, second, ampere, kelvin, mole, and candela), second is NOT REALLY a fundamental unit (time is not a fundamental physical quantity, but speed of change, or speed of moving, or speed of a happening, is). Actually, whenever we describe a time, we use an incident to decribe it. For example, as known to all, when we say: "1 day", it actually means: "the incident that the earth rotates for 1 round (incident A)". And when we say: "1 year", it actually means: "the incident that the earth orbits the sun for 1 round (incident B)". When we compare the happening speeds of incident A and incident B, we can know that the happening speed of incident A is approximately 365 times faster than incident B. Similarly, the happening of a photon changing its position by 300,000km is 24*60*60=86400 times faster than incident A. An example related with everyday life is, when we worry about how many hours does it take for our washed clothes to become dry, we are not worrying about time but actually worrying about the drying speed of our clothes. So when we compare all the speed of happenings in our life and in the universe, we have the impression of time. But time is not fundamental, the concept of time is a generalization and an impression, speed of happening (or speed of moving or speed of changing) is fundamental. When we talk about time, we are actually talking about the speed of the happening of an incident (or the speed of a moving object or the speed of a change). So when we say, time nearly stops(or almost stops), it actually indicates it is extremely slow for an incident to happen, or a moving object is moving extremely slowly, or a change happens extremely slowly. And when we say time completely stop, it indicates that this incident will not happen, this moving object is static, this change will not happen.

It is also worth mentioning here now that, as we previously discussed, when we claim "the universe has just entirely stopped to change for 10 billion years", we would have no comparison regarding the 10 billion years, so it actually is an empty claim.

It is also possible that each fundamental interaction can have its own time: gravity force has its time(t_g), electromagnetic force has its time(t_{em}), ...etc. Or it could be more complicated: for example, it is possible that object's moving has its time(t_m), matter's nuclear reaction has its time (t_n), and matter's chemical reaction has its time (t_c), ...etc. Concerning this, future scientific researches will tell us what the exact results are.

Up to here, we know that time is not an empty concept, the nature of time is about the relative rate of change. And there can be many kinds of change (many kinds of time). Each kind of change (each kind of time) can be irrelevant or can be interrelated. If, for example, on the earth, two hydrogen atoms and one oxygen atom form a water molecule in 10^{-10}second, in contrast, on the surface of a planet 100 times heavier than the earth, two hydrogen atoms and one oxygen atom MIGHT form a water molecule in 10^{-9}second. If so, when we use the reaction speed of "two hydrogen atoms and one oxygen atom forming a water molecule" to measure time, the time will be different on the two planet. This is the nature of time.

So, if gravity can really cause time dilation, it simply means that gravity can alter the rate of change in terms of some fundamental interaction (for example, electromagnetic interaction). If big gravity can cause time to slow down, it simply means that big gravity can slow down the rate of change in terms of some fundamental interaction (for example, electromagnetic interaction) so that this fundamental interaction will become slower. This can be used to explain why atomic clocks become faster or slower in different gravity fields. And if extreme gravity can cause time to stop, it simply means that extreme gravity can extremely slow down the rate of change in terms of some fundamental interaction (for example, electromagnetic interaction) so that this fundamental interaction will not happen. It is absolutely not possible that extreme gravity can cause all change to stop, because in this case we can never observe the happening of a black hole merging with another black hole or a neutron star, as we said earlier. This indicates that gravity can cause electromagnetic force time (t_{em}) to slow down but doesn't have the same influence on gravity force time (t_g). Then it is practically possible for us human beings to alter the rate of change in some occasions, this means we can achieve the result of changing the time (t_{em}) to be faster or slower.

Conclusion:

- Time is a concept used to describe the relative rate of change inside the universe. Time is not an illusion, time is an impression.
- Theoretically, it is possible that time can stop, can go back, or can be not continuous.
- The observations of merger of black holes prove that time, in a general sense, doesn't stop even in extreme gravitational field.
- In a general sense, time also can't be extremely slowed down even when something's travelling speed is extremely close to speed of light.
- It is possible that gravitational fields and high moving speeds can change the speed of electromagnetic interaction(and/or other kind(s) of fundamental interaction)
- It is possible that each fundamental interaction can have its own time: gravity force has its time (t_g), electromagnetic force has its time(t_{em}), etc
- It is possible that time can, under certain circumstance, start to go on at a faster or slower rate.

Acknowledgement:

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