Superluminal Propagation of Pulse as another Ultra-Fast Phenomenon, And its Application

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[1,2,3,4]Family Research group on superluminal phenomena and communications

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ABSTRACT: Another kind of ultra-fast phenomenon, superluminal transmission of light pulse，was proposed, its velocity can faster than the infinite that was proved in theory and experiment. Based on two kinds of epistemology and world, both deeply effects on Science and technology and open new application of Laser discussed briefly. We also suggested add the content of two kinds of epistemology and worlds in Physics to clear the relationship between the Relativity and general Physics.

I. INTRODUCTION

The WKD experiment result always attracts us [1], we think light pulse is an assemble of photons in time-space. This result conflicts with the Einstein's conclusion: nobody (including the signal) can move faster than c [2]. According to the practice is the sole criterion for testing truth. We think the validity of Einstein's conclusion need to be study, it will make influence on Physics and Informatics deeply and is very important, fail in after many times application to get support we decided to make a "family research group" to study this question and get break though. Now introduce them as following.

II. CAUSE OF THE SUPERLUMINAL LIGHT PULSE, AND IT IS FALSE OR TRUE.[3]

For a pulse U(r,t), we have

$$U(r,t) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} A(\omega) e^{i(\omega t - kr)} d\omega \tag{1}$$

Here $k = \omega n/c$, if this pulse propagates in a medium with constant dispersion D, for first approximation we get

$$U(r,t) = \frac{2}{\sqrt{2\pi}} \frac{\sin(t - \frac{r}{c}(n_0 + \frac{dn}{d\omega}\omega_0))\Delta\omega}{t - \frac{r}{c}(n_0 + \frac{dn}{d\omega}\omega_0)} A(\omega_o') \exp[i\omega_o(t - \frac{r}{c}n_o)] = C(r,t)\exp[i\omega_o(t - \frac{r}{c}n_0)] \tag{2}$$

After reshaping by dispersion this pulse can be represented by function C(r,t), the position of peak at

$$t - \frac{r}{c}(n_0 + D\omega_0) = t - r/v_g = 0 \cdot \tag{3}$$

it propagates with velocity $v_g = c/(n_o + D\omega_0)$. by choice D, We can get different v_g. it can larger than c or be negative, we also proved $v_g < 0$ is faster than the infinite, the time advance of output pulse happen, that also be proved by computer simulation. For the false of true of the pulse in WKD experiment, we have proved the deduce method and conclusion of Sommerfeld and Brillouin, v_e must less than **c [4],** are wrong, since the inner energy of medium can't take part in the energy transmission and only affect the value of the electromagnetic field. v_e can larger than c. we get advance time in WKD experiment is -62ns, it coincides with the measured value -63±1ns.very well.

III. DISCUSSION OF THE CONTRADICTION BETWEEN SUPERLUMINAL PHENOMENA AND THE SPECIAL RELATIVITY (SR).[5]

Although the Einstein's conclusion be considered as a universal truth, but recently the superluminal phenomena occur often, We discussed this contradiction from three aspects: 1, Epistemology; 2, defect of the Special Relativity; 3, The essence of SR；

(1), Epistemology: Human being has two kinds of method to recognize the external world right now:

A. **Objective epistemology**: external body exists objectively and is independent of our observation. All of the bodies in the external world constitute an **objective world**. The subjects independent of observation: such as Physics, mathematics, classical mechanics, quantum mechanics etc. belong to this epistemology. They are dealing with objective or real law of variance or movement of body. All of them recognize the Superluminal phenomena. This is why the classical and quantum mechanics conflict with Relativity in superluminal phenomena.

B. **Subjective (or visual) epistemology**: we recognize the existence of body is due to we receive its signal and produce a vision sense on retina. Since the value of light velocity is limited, signal from body to eyes need a certain time Δt. For a moving body, when you have seen, it has left its original position by a distance ΔL= v×Δt, (or $\Delta L = \int_0^{\Delta t} \vec{v} dt$), v is velocity. The body seen by you is only an image (Δt ago), such as the Sun you seen is 2.5 minutes ago and several thousand mails apart from real one. All discussions in such case only refer to the image of body and not itself. All images of body seen by us also constitute **a virtual world.** The observer is at the center of all events, and all observed results are relative.
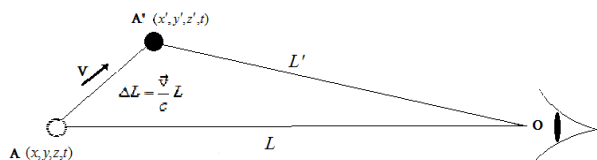

Fig1. The relationship between object and its image for a motive body.

The Relativity and Astronomy just belong to the Subjective epistemology, the observed result depends on the observer. Its research always bound with light velocity c. Since the value of

c is limited, the visual phenomenon is different from the real fact. The larger velocity, the farther distance and the more the difference between them. Therefore, the celestial structural diagram in Astronomy is different from real one that is interesting for Astronautics. The Relativity is an imaginary theory.

Our research shows the superluminal is a natural phenomenon this idea has been receipted by Encyclopedia of China [6].

(2) The defects of SR

1). The contraction of ruler, and retardation of clock in moving system is an important result of Lorentz transformation [2]. But there is some strangeness in such result. Suppose have two systems A(x,y,z.) and A'(x',y',z') with relative motion velocity v. Form the Lorentz transformation can get

$$x_2' - x_1' = (x_2 - x_1)\sqrt{1-(v/c)^2}; \quad t_2' - t_1' = (t_2 - t_1)/\sqrt{1-(v/c)^2}.$$
(4)

And from its reverse transformation, also can get

$$x_2 - x_1 = (x_2' - x_1')\sqrt{1-(v/c)^2}; \quad t_2' - t_1' = (t_2' - t_1')/\sqrt{1-(v/c)^2}.$$
(5)

An observer in system A or A' sees the ruler contraction and clock retardation in other system. which one is correct? What is the matter?

2). Problem of Addition theorem of velocity.

From Lorentz transformation, Einstein got the famous addition theorem of velocity:

$$u = (u' + v) / (1 + \frac{u'v}{c^2}) \qquad (6)$$

Different from the velocity addition in classical mechanics，if u'= c and v = c, we still get u = c. This is the reason that Einstein asserted that any velocity can't be larger than c in the Relativity. The question is here v is the relative velocity of two system, but u' and u are the velocity with different units of time and length in different systems. How can we put them together to plus or minus? We think the formula (8) should called as the corresponding theorem of velocity. i.e. the velocity u in system A corresponds to a velocity u' in system A' - they have different units and are different quantity in different systems.

3). the invariance principle of light velocity is incorrect.

Einstein considered the light velocity is a solution of Maxwell equation and should independent of the situation of

light source and observer [2]. He thought if you fellow a light beam go forward with velocity c and look at another light beam it still travels with velocity c and the light velocity for coach is same as for roadbed. But in medium since the dragging effect, light velocity vary with the situation of the observer obviously; even in vacuum, the interference of two light beams also shows that two light beams are relative rest; Vacuum is a material, in fact the reference system for solving Maxwell equation is vacuum itself, so that the light velocity is c only for the rest observer to vacuum. In our opinion, the light velocity just as any kind of velocity of bodies, such as train, ship or sound velocity, all of them depend on the observer situation. No exception for light velocity, i.e. the invariance principle of light velocity is invalid. The idea of invariance of light velocity also conflicts with the relativity of the results of observation that is a basic idea in Relativity.

(3) *The essence of the SR.*

In general speaking, we define the subject deals with the visual law of body motion `as the visual mechanics corresponding to the classical mechanics which deals with the real law of body motion. Usually there are two kinds of the visual phenomena we have to study.

1, an observer studies the body motion in different inertial systems.

2, the observers in different inertial system deal with the same body motion in another system.

For distinguishing we call the first situation as the real visual mechanics and the second as the pseudo visual mechanic. We have deduced the transformation of the time-space quantities for the real visual mechanic is

$$y' = y, \quad z' = z, \quad x' = x - vt, \quad t' = (1 - v/c)t;$$
$$y = y', \quad z = z', \quad x = x' + vt', \quad t = (1 - v/c)t'. \quad (7)$$

That corresponds to Galileo transformation in classical mechanics. Here no limit for both v and t, when v = c, no relation between t and t'; and when v> c, t = -kt', k= v/c-1, means observer can't receive the present and future signal from the opposite，just corresponding to "Black hole", the negative relation maybe means the former situation, and the covariance of time-space quantities in the real visual mechanics should be

$$x^2 + y^2 + z^2 - c^2t^2 = x'^2 + y'^2 + z'^2 - c'^2t'^2 \quad (8)$$

Since the light velocity is different in different systems for an observer, c ≠c', no solution for (8), but from equation (7) we can get

$$c' = c - v; \quad c = c' + v. \quad (9)$$

This result can be proved by the experiments. It means the light velocity for coach and roadbed is different.

On other hand, based on the other fact in each system light velocity is c for a still observer in each system. We defined the intervals of events [6] in each system are

$$S^2 = x^2 + y^2 + z^2 - c^2t^2, \quad S'^2 = x'^2 + y'^2 + z'^2 - c^2t'^2. \quad (10)$$

Put $S^2 = S'^2$, i.e.

$$x^2 + y^2 + z^2 - c^2t^2 = x'^2 + y'^2 + z'^2 - c^2t'^2 \quad (11)$$

Einstein got the Lorentz transformation from equation (11).

$$x' = \frac{x - vt}{\sqrt{1 - (v/c)^2}}, \quad t' = \frac{t - vx/c^2}{\sqrt{1 - (v/c)^2}} . y' = y, z' = z.$$

$$x = \frac{x' + vt}{\sqrt{1 - (v/c)^2}}, \quad t' = \frac{t + vx/c^2}{\sqrt{1 - (v/c)^2}} . y = y', z = z'. \quad (12)$$

The equations (8) is for one observer and two systems and (11) is for two observers and two systems. Obviously, SR only is the theory of the second visual mechanic. Lorentz transformation gives the time-space relation between two observers studying same event in different system. SR only provides a method to study second kind of visual phenomena and is the pseudo visual mechanic that different from the real visual mechanic. When v<<c, we can consider the light velocity is invariance approximately for most celestial body fit this condition, two transformation are equal, SR is pseudo visual mechanic also approach the real visual mechanic. But we need to point out that: 1, in fact equation (11) does not need the invariance principle of the light velocity, since in vacuum the light velocity is c for any still observer respect to the system, it is a fact and very different from the velocity is independent of observer situation; 2, the prerequisite of formula (11) is v ≤ c, otherwise the coordinates are imaginary, v = c is a strange point. So that SR can't deal with superluminal problems. This is the limitation of SR and not means superluminal do not exist. Therefore, SR can't be used to deny superluminal phenomena.

We discuss the defects of SR, only want to show SR isn't a truth. There are some mistakes need to correct.

IV. INFLUENCE OF SUPERLUMINAL RESEARCH ON PHYSICS AND INFORMATICS

Influence of superluminal research on Physics

We think at first, the content of two epistemology and two kinds of world should be add in physics. The Relativity and

Astronomy study the problems about visual phenomena, the general physics, Classical mechanics and Quantum Mechanics study the problems that irrelevant vision, they belong to different category we can't confuse them. On other hand, the Relativity only is one kind of visual epistemology. Einstein as a greatest Scientist made so many contributions to physics but he neglected the difference between two kinds of epistemology and world, to correct this is a enrich and supplement to the Relativity. It will help to solve some meaningless arguments in physics. Such as body velocity can't larger than c only valid in SR not in any case: Superluminal is a natural phenomenon, neutrino speed slight larger than c observed by European scientist is correct. In fact, in 1987 observation of superstar explosion neutrino arrived the globe before the photon has been observed [7]. the research of visual Mechanics still needs go deep into. Is the Relativity kinetics only introduce the Lorentz transformation in Classical kinetics? Does the recent method proposed to study superluminal motion correct? Does The point-view of universe in the Relativity coincide with the reality. All of them still need to study again.

Influence of superluminal research on Informatics[9-11]：

In this research，we think the phase velocity and group velocity are two basic velocity in Informatics, the transmission velocity of information in analogy communications is the phase velocity of the load wave and is the group velocity in digital communication. Both of them can larger than c. group velocity depends of the dispersion of medium can less, larger than c, even take a negative value, negative group velocity faster than the infinite can be used to make a "time compensator". we have proved the superluminal pulse can propagate long distance without distortion [12] and can be used to transfer information. Generally, the development of the communications technique is around to solve three problems 1, safe and reliable: 2, larger capacity; 3, fast transmission. Except the first task need by virtue of code and quantum technique, since the capacity of the system is ratio to signal speed. So that single channel can has several Tbts capacity. The signal superluminal transmission also can raise the computer operate rate and the precision of remote control and testing, especially the time compensator will create a new prospect in interstellar communications as well as remote control and testing, also promote the born of the superluminal informatics. so that to develop the superluminal communications will be a strategic task,

V. SUMMARY

Here we introduced a new ultra-fast phenomenon, superluminal transmission of light pulse. Especially negative group velocity is fast than the infinite, time advance of output pulse happen. We corrected some mistake in SR, since that block the development of science and technique and cause meaningless argue in physics. We must face up to the theories of our predecessors correctly，uphold truth and correct mistake that is the greatest respect to them. Only do like this in order to develop science and technique rapidly. The superluminal propagation of light pulse is due to the reshaping the pulse by the medium dispersion. The time advance of output pulse has larger prospect of application in remote control and testing as well as interstellar communications in future, and give new possibilities for ultra-fast objects and Research, also it will open up a new field of application and research of Laser application. Specially proposed to share and discuss with you.

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