Think Again : About the Time Interval

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ABSTRACT

The same place twice at different time of events, respectively, in different frame of reference in different time intervals observer. Relative to the incident site in the frame of reference movement observer, receives signals twice larger than the time interval is always associated event . This formula is called the famous clock inflation , usually expressed as $\Delta t' = \Delta t / \sqrt{1-\beta^2}$. The authors ponder earnestly and strict proof, time interval is not confined to inflation , it also exists shrinks . [Academia Arena,2009;1(5):83-88].ISSN 1553-992X.

Key words: transmission time , time interval , interval dilation , interval contraction

1. INTRODUCTION

About inflation this concept, clock , and is not time clock running faster or slower, also not run in real time slows down , but by the spread of light signals caused by different reference frame the same signal timing, receiving . Namely, the time interval is changed . For example: imagine a signal transmitters on the moon , every 10 minutes to launch a signal to the earth , existing two spacecraft in the earth and the moon between 10 million kilometers to/SEC movement (this hypothesis of this speed, only for theoretical explanation). A ship is flying to the earth, and another vessel flying to the moon , shuttle and earth is identical to the mechanical properties of the clock (or recorder) . Ask: the two spacecraft and earth measured signal period for each ?

The earth to receive signals interval is the moon signals emitted from cycle, $\tau = 10$ minutes.

The shuttle S_1 flies to the earth $\tau_1' \approx \tau + \dfrac{V}{c-V}\tau \approx 10 + 10\times 10/(30-10) \approx 15$ minutes.

The spacecraft S_2 flying to the moon $\tau_2' \approx \tau - \dfrac{V}{1+V}\tau \approx 10 - 10\times 10/(30+10) \approx 7.5$ minutes.

The records from their respective reference frame data display, the reference frame S_1 time interval expansion , reference frame S_2 time interval contraction . According to the clock inflation formula, we are:

$\Delta t' = \Delta t / \sqrt{1-(\frac{V}{C})^2} = 10 \Big/ \sqrt{1-(\frac{10}{30})^2} \approx 10.6$ minutes . What's the difference among τ_1', τ_2'

and $\Delta t'$? Therefore , make a concrete analysis .

2. EXPANSION AND CONTRACTION OF THE TIME INTERVAL

The same place twice at different time of events, respectively , the time difference between the two events, called time interval . Reference frame away from light exercise, receive twice larger than the time interval event occurs . Similarly, reference frame movement toward the direction of event occurred , time interval happen contraction . Therefore , the expansion or contraction time interval is spread by light signals in the process of a kind of effect .

2.1 Time Interval Inflation

As figure 1 and 2 shows, When along the X-axis movement systems S' and stillness reference frame S completely coincidence moments, from the light-source point P shining a pulse . Set in point P, O and O' points at the three time clock timing starts , time this concept has been Newtonian in Philosophic Naturalis Principle Mathematical in , time clock is used for measuring " real " time of a kind of instrument (timing is used to measure time clock of an instrument.). The second flash launch is in the first time interval $\boldsymbol{\tau}$, along the X-axial movement speed reference frame S' for V. The origin of the reference frame S' in the X- axis at different times with the "special" nature of space location: A, B, M, N …….

Point E : Is in the X-axis space point P on the corresponding coordinates .

Point A : Inertia reference frame S' coincides with static system S completely moments, point P launch first flash .

Point B : In the reference frame S' observer to receive first flash signals in space .

Point M : The second flash light emission in time interval $\boldsymbol{\tau}$, the spatial position of reference frame S'. Authors assume that "special" spatial point have a stationary coordinate system S_k , and they kept relatively quiescent state: coordinate system S_k , point P and reference frame S . The space location in reference frame S_k point P for $(x-V\tau, y_0, z_0)$, instant space-time as $(x-Vt, y_0, z_0, \tau)$.

Point N : To receive the second signal time reference frame S' in space. Assume the second flash light spherical spread to the reference frame S_k origin M time for t_m (the light signal transmission time) . $t_m \neq \tau$.

According to the Pythagorean theorem, we obtain spherical equation in the reference frame S :

$$(x-Vt)^2 + y_0{}^2 + z_0{}^2 = (ct_m)^2 \quad , \tag{1}$$

Move along the X-axis reference frame S', spherical surface continued to spread in, the ball on the pursuit of diffusion in face of reference frame S' observer. At this moment, in reference frame S' to read the clock is t_n , instant space-time as $(x - V\tau - Vt_n,\ y',\ z',\ \tau + t_n)$. Figure 1 in analysis, obviously .

$$[(x - V\tau) - Vt_n]^2 + y'^2 + z'^2 = (ct_n)^2 \quad , \tag{2}$$

The x'-shaft and X- axle load , reference frame S' along the X-axis movement, around the X- axis rotation does not. That is , $y' \parallel y$, $z' \parallel z$. $y'=y$, $z'=z$, $x'=x-vt'$. Will formula (1) and (2) joint solution formula we have :

$$t_n = \frac{\sqrt{\left(1-\beta^2\right)t_m{}^2 + \beta^2\left(x - V\tau\right)^2 / c^2} - \beta\left(x - V\tau\right)/ c}{1-\beta^2} .$$

(3)

From point P to N , t_n say flash signal transmission (or light spherical diffusion) time value . When the movement reference frame S' and stillness systems S coincides moments, first flash point P, two reference frame observer and start the timer . Reference frame S' in each "special" space stations of clocks is respectively: read the numerical T_A, T_B, T_M, T_N.... . According to the Yang Fa-cheng papers: Think of the Relationship Between Time and Space Again , that is :

$$T_B = \frac{\sqrt{(1-\beta^2)t_a{}^2 + \beta^2 x^2 / c^2} - \beta x / c}{1-\beta^2} .$$

So are:

$$T_A = 0, \qquad T_B = \frac{\sqrt{(1-\beta^2)t_a{}^2 + \beta^2 x^2 / c^2} - \beta x / c}{1-\beta^2} , \qquad T_M = \tau \ \text{ and } \ T_N = \tau + t_n .$$

In figure 2, reference frame S' observer to receive the flash signals twice, is the time interval value τ'.

$$\tau' = T_N - T_B = \tau + t_n - T_B$$

$$= \tau + \frac{\sqrt{(1-\beta^2)\ t_m^2 + \beta(x - V\tau)^2 / c^2} - \beta(x - V\tau)/c}{1-\beta^2}$$

$$- \frac{\sqrt{(1-\beta^2)t_a{}^2 + \beta^2 x^2 / c^2} - \beta x / c}{1-\beta^2} .$$

(4)

This formula is used for measuring precision of expression .

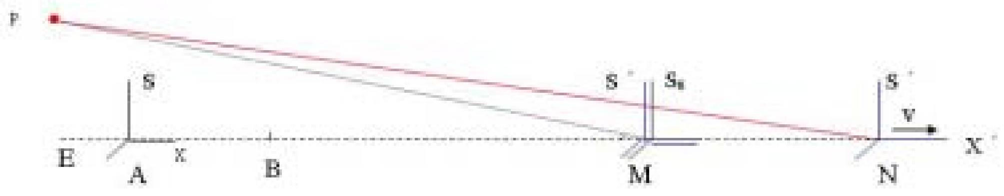

Fig.1 Point P: is fixed in the reference frame S in any position. The reference frame S' reached A position movement, light source point P emission first flash. It reached M position movement, the light-source point P emission second flash.

Fig.2 Sports reference frame S' to receive first flash at point B, It receives the second flash signals in point N .

Humans always trying to seek the simple method to approximate an objective reality . Therefore, the approximate calculation method for use under the simplified formula (4) . In this paper, in the first flash after launching , time interval is long enough to occur in the second flash . Have the following conditions:

$\overline{AM} = V\tau$, $\overline{EM} = |x - V\tau|$ (because the time interval $\boldsymbol{\tau}$ is long enough),

$\sqrt{y^2 + z^2} / c \cdot t_m = \sin x \to 0$, $V\tau >> |x|$, namely

$EM = |x - V\tau| \approx V\tau$, $PM = c\,t_m \approx |x - V\tau| \approx V\tau$.

$t_m \approx V\tau / c$, $t_a = (po / c) \to 0$, $(x / c) \to 0$.

By above knowable series conditions $T_B \approx 0$,

Thus: $\tau' = T_N - T_B$

$$\approx \tau + \frac{\sqrt{(1-\beta^2)V^2\tau^2/c^2 + \beta^2 V^2\tau^2/c^2} + \beta V\tau/c}{1-\beta^2} - 0$$

$$\approx \tau + \frac{\pm V\tau/c + V^2\tau/c^2}{1 - V^2/c^2} \quad .$$

(5)

In the formula (5), we have taken:

$$\tau' \approx \tau + \frac{V(c+V)\tau}{c^2 - V^2} \approx \tau + \frac{V}{c-V}\tau \quad .$$

(6)

This formula is called time interval inflation .

Along the X -axial movement speed reference frame S 'for V , and speed $V(0 < V < C)$.

If $V \geq C$， then Eq.(1) and (2) all do not hold water．

2.2 Under Special Circumstances Time Interval Inflation

As Fig.4 shown, the clock inflation formula $\Delta t' = \Delta t / \sqrt{1 - V^2 / c^2}$, its essence is refers to the "special" situations, different locations of the two events occur at the same time． In the movement of the inertial system S' in large measure time intervals than static reference frame S of the time interval. Flash diffusion time for t_1, from point P to A． Flash diffusion time for t_2, from point Q to A． According to formula

$t = t_0 \Big/ \sqrt{1 - (\frac{V}{C})^2}$, We have $t_m = t_1 \Big/ \sqrt{1 - (\frac{V}{C})^2}$ and $t_n = t_2 \Big/ \sqrt{1 - (\frac{V}{C})^2}$ ． So are:

$$\Delta t' = t_n - t_m = (t_2 - t_1) \Big/ \sqrt{1 - (\frac{V}{C})^2} = \Delta t \Big/ \sqrt{1 - (\frac{V}{C})^2} \ .$$

Is the signal propagation delay effect [1,2]．

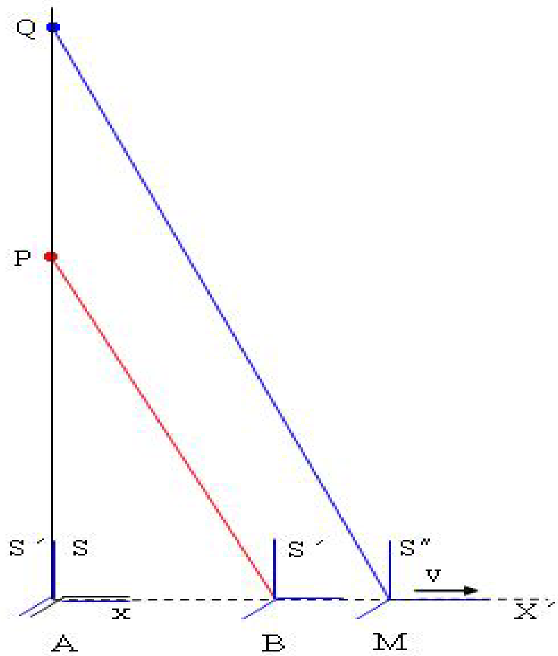

Fig.3 In the y -axis different location of two point light-source, two point light flash pulses fired at the same time. In the reference frame S, received two flash time interval is Δt .
In the reference frame S', received two flash time interval is $\Delta t'$.

2.3 Time Interval Contraction Expression

In front of the reference frame S' is discussed from light exercise． If the reference frame S' is toward the light exercise, the speed of reference frame should take negative（-V）, we obtain :

$$\tau_2' = \tau + \frac{-(cV - V^2)}{c^2 - V^2}\tau \approx \tau - \frac{V}{c+V}\cdot\tau \quad .$$

(7)

This formula is called time interval contraction . It is suitable for low speed frame of reference , also suit superluminal motion inertia system .

3. CONCLUSION

The same place twice at different time of events, respectively, in different reference frame in different time intervals . Reference frame movement away from the incident site, time interval inflation . Reference frame movement toward the direction of event occurred , time interval happen contraction .

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