Wave-like properties of Time

Goutam Kumar Chandra[1]*

[1]Department of Electronics and Telecommunication Engineering,Indian Institute of Engineering Science and Technology, Shibpur
Howrah, West Bengal, 711103 , India
*chandratphysics@rediffmail.com

Abstract

Time is a component quantity of various measurements and is also used on its own to sequence events, to compare the duration of events or the intervals between them, and to quantify rates of change of quantities in material reality or in the conscious experience [1]. The measuring equipment well might happen to be a clock. By making a presupposition that clock is Time, it is perceived experimentally that "Time exhibits wave-like properties"

Keywords: Tools and Metrology, Time and Frequency, Philosophy of Science , Special Relativity, Semiconductors

PACS Nos : 06.20.-f, 06.30.Ft , 01.70.+w ,03.30.+p , 61.82.Fk

---

1. Introduction

Time has been a perplexing quantity since Galileo's time, it plays a predominant role in science and philosophy and religion. Many philosophical, metaphysical and physical interpretations of time have been introduced by Galileo, Newton, Einstein and other philosophers [1-2]. Space was considered a Euclidean element since Newtonian time. Einstein replaced Newtonian laws of motion in 1905 in his theory of Special Relativity, where the speed of light in vacuum has the same value 299,792,458 m/s irrespective of reference frame. This 1905 theory also unified space and time so-called space-time

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 January 2021 doi:10.20944/preprints202101.0127.v1

continuum, where time is a coordinate time and complex. What is known till date is that proper time is what an ideal clock measures [3]. In this paper, I have tried to give unified understandings to time and space-time experimentally. However, in order to do so, I must construe the Michelson, Morley experiment [4] as proving Special Relativity's postulate

2. Experimental Setup

An experiment was done by synchronizing two digital clocks at the same time, which could measure precisely every second. Both the digital clocks are electronically displayable 'hh: mm: ss' time format using the LCD. The clock pieces are made with the same technology and are similar in structure. The digital clock consists of the ill effect of timing jitter [5].Both the clocks navigated different paths compared to each other over the duration of ten days and Δt being measured continually within some finite time intermission at the observed reference frame O. Where Δt is the time difference between two clocks at a certain point in time. The moving digital clock acts as a space-time odometer. The environmental condition was similar to both the clocks during these ten days' time. Let's represent two clocks as two additional reference frames. Let the first one be, called S and the other be, called S' . S has a co-ordinate $\{x, y, z, t\}$ within S and S' has a co-ordinate $\{x', y', z', t'\}$ within S'. S and S' moves in uniform relative motion (velocity v) along the common direction of x and x'.The clock synchronization was done at time $t' = t = 0$. Initially S' was kept 3 seconds ahead of S,so Δt=3.The velocity of S' was greater than the velocity of S, but the relative velocity between S' and S, $v \ll \boldsymbol{c}$, where $\boldsymbol{c}$ is the speed of light in vacuum. Δt was detected to be a non-determining wave-like function over time.

3. Supporting Mathematics

$f_1(t)$and $f_2(\mathrm{t})$ be the corresponding time function for S' and S

$$f_1(t) - f_2(t) = \Delta t \quad (1)$$

Δt is a time reliant on wave-like function shown in Fig.1.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 January 2021 doi:10.20944/preprints202101.0127.v1

Lemma: *if* Δt *is a time reliant on wave-like function,* $f_1(t)$ *and* $f_2(t)$ *similarly be a wave-like function.*

If clock measure time we have the following set of equations.

$x' = x - vt$ (2)

$y' = y$ (3)

$z' = z$ (4)

$t' = t$ = wave-like function (5)

So, Minkowskian $\mathbb{R}^4$ flat space-time can be deduced by

$ds^2 = -df(t)^2 + dx^2 + dy^2 + dz^2$ (6)

Where $f(t)$ is a wave-like time function

If the clock doesn't measure time we have the following set of equations.

$x' = x - vt$ (7)

$y' = y$ (8)

$z' = z$ (9)

$t' = t = 0$ (10)

So, Minkowskian $\mathbb{R}^4$ flat space-time can be deduced by

$ds^2 = dx^2 + dy^2 + dz^2$ (11)

Which is a Euclidian $\mathbb{R}^3$ Space

4. Conclusion

Can we determine time manifesting wave-like

behavior

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 6 January 2021 doi:10.20944/preprints202101.0127.v1

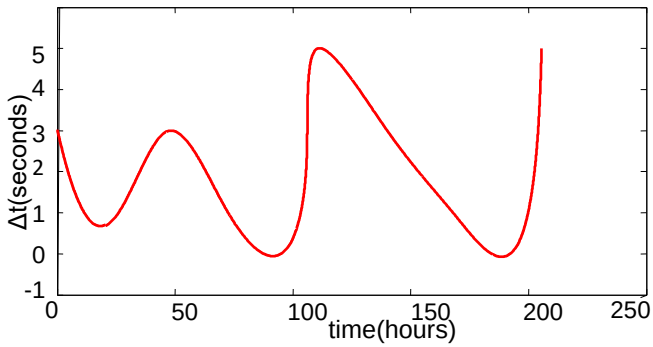

Fig.1 Because of pll jitter component, moving digital clocks goes both slow and fast

References:

[1] Le Poidevin, R. The experience and perception of time. In: Zalta E.N. (ed.) The Stanford Encyclopedia of Philosophy (Winter 2004 Edition) https://plato.stanford.edu/archives/win2004/entries/time-experience/

[2]Einstein, A. Zur Elektrodynamik bewegter Körper. *Ann. Phys.* **322**,891-921(1905).

[3]Ashby, N. Relativity in the Global Positioning System.*Living Rev. Relativ.* **6**,1-42(2003).

[4] Michelson, A.A., Morley, E.W.On the Relative Motion of the Earth and the Luminiferous Ether. *Am. J. Sci.* **34**, 333–345(1887).

[5] Lee, D.C. Analysis of jitter in phase-locked loops. *IEEE Trans. Circuits Syst. II Analog Digit. Signal Process.* **49**,704-711(2002).