

# Quantum Time is derived from Motion

Amrit S. Sorli  
Scientific Research Centre BISTRA,  
Ptuj, Slovenija  
[sorli.bistra@gmail.com](mailto:sorli.bistra@gmail.com)

## Abstract

In physics spatial distance  $d$  is a product of velocity  $v$  and time  $t$ :  $d = v * t$ . Mathematical formalism  $x_4 = i * c * t$  confirms that in Special Theory of Relativity fourth coordinate  $x_4$  is spatial too.  $x_4$  is composed out of  $c$  light speed, imaginary number  $i$  and time  $t$  that represents “tick” of a clock. Time  $t$  obtained with clocks describes numerical order of material change  $t_0, t_1, t_2, \dots, t_n$ . Clocks are reference systems for measuring frequency, velocity, numerical order of material changes that run in space. Time  $t$   $x_4$  is running of clocks in space. Clock/time is a measuring reference system for measuring physical events that are running exclusively in space and not in time. Light speed  $c$  of light motion is a fundamental speed in the universe on which is calculated basis unit of time “Planck time”. This view explains some recent experiments which confirm that time  $t$  of physical event can be zero.

**Key words:** time, run of clocks, numerical order, frequency, velocity, light speed

## Introduction

Light speed  $c$  of light motion is a fundamental speed in the universe on which is calculated basis unit of time “Planck time”:  $t_p = \frac{c}{l_p}$ , where  $l_p$  is a Planck distance:

$l_p = \sqrt{\frac{\hbar G}{c^3}} \approx 1.616252(81) \times 10^{-35}$  meters.  $G$  is gravitational constant and  $\hbar$  is the reduced Planck constant.

Planck time  $t_p$  is the basic unity for measuring frequency, velocity and numerical order of physical events. Time as a clock run is not a part of space; time/clock run is a reference system to measure physical events i.e. material change. In Lorentz transformation time  $t$  and  $t'$  are running of clocks for two observers Q and Q'.

$$\begin{bmatrix} ct' \\ x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} \gamma & -\beta\gamma & 0 & 0 \\ -\beta\gamma & \gamma & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}.$$

where  $\beta = \frac{v}{c} = \frac{\|\vec{v}\|}{c}$  and  $\gamma = \frac{1}{\sqrt{1-\beta^2}}$ .

## Discussion

For certain physical phenomena time is zero, since no measurable time (no run of clocks) elapses for them to happen. For example in the article *Attosecond Ionization and Tunneling Delay Time Measurements in Helium* by Eckle et al, a conclusion is drawn that "an electron can tunnel through the potential barrier of a He atom in practically no time" (1).

Also in EPR experiment elapsed time for quantum entanglement is zero. EPR does not happen in space and time, EPR happens in space only. Here physical space in which particles exist is being considered direct information medium between entangled quanta (2).

The physical space as an "immediate information medium" resolves the causality problem of the Fermi two-atom system: "Let A and B be two atoms or, more generally, a "source" and a "detector" separated by some distance R. At  $t=0$  A is in an excited state, B in its ground state, and no photons are present. A theorem is proved that in contrast to Einstein causality and finite signal velocity, the excitation probability of B is non-zero immediately after  $t=0$ . Implications are discussed"(3). The excitation probability of B is non-zero because the physical space in which atoms exist is an "immediate medium of excitation".

More and more modern researchers are challenged with the view that space-time is the fundamental arena of the universe. They point out that the mathematical model of space-time does not correspond to physical reality, and propose "state space" as the arena instead.

One recent paper on the subject is: *A New Geometric Framework for the Foundations of Quantum Theory and the Role Played by Gravity*. Since quantum theory is inherently blind to the existence of such state-space geometries, the analysis here suggests that attempts to formulate unified theories of physics within a conventional quantum-theoretic framework are misguided, and that a successful quantum theory of gravity should unify the causal non-Euclidean geometry of space time with the atemporal fractal geometry of state space (4).

In 1949, Gödel postulated a theorem that stated: "In any universe described by the theory of relativity, time cannot exist" (5). This article confirms that universe is a timeless phenomena, universe does not run in time, time is not part of the universe; clock/time is merely a measuring system for physical events. Duration of physical events has no existence on its own. Duration is result measurement with clocks. Duration is an "effect of observation". In the universe only permanent changes exist that has no duration on its own. Changes are irreversible. Past and future does not exist in the universe. Space-time is merely a mathematical model and not fundamental arena of the universe. Time as a run of clocks in timeless universe excludes possibility of time travel. One can travel in cosmic space only and not in time.

Motion does not happen in time and also does not always require time. Massive bodies and elementary particles move in timeless universe. Timelessness of the universe we experience as present moment. We live in illusion that present moments are following each other, we are not aware that physical events always run in the same present moment. When this illusion will be resolved than physics will build up a theory that will connect General Relativity that describes motion of stellar objects and quantum mechanics that describes motion of elementary particles.

## Conclusions

Idea of space-time being fundamental arena of the universe has no experimental data and has to be replaced with Gödel idea of timeless universe. Time is not part of physical space in which massive bodies and elementary particles move. Physical events happen in physical space only and not in time. Time as a clocks run is merely a measuring device for physical events.

## References:

1. Eckle, A. N. Pfeiffer, C. Cirelli, A. Staudte, R. Dörner, H. G. Muller, M. Büttiker, U. Keller, Attosecond Ionization and Tunneling Delay Time Measurements in Helium, Science, Vol. 322. no. 5907, pp. 1525 – 1529 (2008) <http://www.sciencemag.org/cgi/content/abstract/322/5907/1525>
2. Fiscaletti D. Sorli A.S. Non-locality and the Symmetryzed Quantum Potential, Physics Essays, December 2008, Vol. 21, No. 4, (2008)
3. Gerhard C. Hegerfeldt. Causality problems for Fermi's two-atom system, Phys. Rev. Lett. 72, 596 - 599 (1994). [http://prola.aps.org/abstract/PRL/v72/i5/p596\\_1](http://prola.aps.org/abstract/PRL/v72/i5/p596_1)
4. T.N.Palmer, The Invariant Set Hypothesis: A New Geometric Framework for the Foundations of Quantum Theory and the Role Played by Gravity, Submitted on 5 Dec 2008, last revised 17 Feb 2009, <http://arxiv.org/abs/0812.1148>
5. Yourgrau P. A World Without Time: The Forgotten Legacy of Godel and Einstein, Amazon (2006) [http://findarticles.com/p/articles/mi\\_m1200/is\\_8\\_167/ai\\_n13595656](http://findarticles.com/p/articles/mi_m1200/is_8_167/ai_n13595656)