

# Two Fundamental Approaches on Time

Amrit S. Sorli

[sorli.bistra@gmail.com](mailto:sorli.bistra@gmail.com)

Scientific Research Centre BISTRA, Ptuj  
Slovenia

## Abstract

Today in physics there are two fundamental approaches on time. First is that clocks run in space-time as a basic physical reality. Second approach is that clocks run only in physical (cosmic) space and clock's run is time itself. First approach has limitations regarding quantum non-locality and superluminal phenomena. It has no experimental evidence, space-time as a fundamental physical reality in which material change run cannot be observed. Second approach introduces "strange" idea that physical space itself is immediate information transfer medium between elementary particles. Second approach is confirmed with experimental evidence. Each experiment conforms that with clocks we measure duration and numerical order of material change that run in physical space. Clocks do not run in time, clock's run itself is time. Run of time is relative; speed of clocks depends on strength of gravity force in different areas of physical space.

**Key words:** time, physical space, duration, numerical order, information

## Introduction

There is no experimental evidence for space-time existing as physical reality. In physical experiments one observes stream of material change in physical space only. Physical space is a medium in which massive bodies and elementary particles move. Space-time is not a physical reality, space-time is merely a mathematical model with which one describe stream of material change in physical space. With clocks we measure duration and numerical order of material change that run in physical space. There is no evidence that material change happens in time; we can only observe stream of material change in physical space. Here time is defined as: Time is run of clocks in physical space. Physical space itself is timeless (atemporal). Travel into past are out of question.

## Discussion

Several researches confirm that space-time as an "arena" of the universe does not correspond to the physical reality. They propose "timeless space" as an arena of the universe.

An article discussing that model of space-time is not corresponding physical universal space and could be replaced with atemporal fractal geometry of state space was recently published on arxiv (1).

An article discussing possibilities that space is timeless was recently published in arxiv: "We illustrate our proposal using a toy-model where we show how the Lorentzian signature and Nordstroem gravity (a diffeomorphisms invariant scalar gravity theory) can emerge from a timeless non-dynamical space" (2).

### **Relativity of Time**

According to this understanding of time in the Special Theory of Relativity in a faster inertial system the speed of clocks (time) and material change in general, is lower than in a slower inertial system. In General Theory of Relativity in physical space with stronger gravity the speed of clocks (time) and material change is lower than in cosmic space with a weaker gravity field.

This understanding of time resolves the problem of twins. They do not live in time; they live in space only. A brother in a high-speed spaceship is getting older slower than his brother on Earth, but both are getting older in a physical space only and not in time. With clocks we measure biological changes in their bodies.

### **Direct Quantum Information**

Some research shows that quantum direct communication is a real phenomenon: "We show how continuous-variable systems can allow the direct communication of messages with an acceptable degree of privacy. This is possible by combining a suitable phase-space encoding of the plain message with real-time checks of the quantum communication channel. The resulting protocol works properly when a small amount of noise affects the quantum channel. If this noise is non-tolerable, the protocol stops leaving a limited amount of information to a potential eavesdropper"(3).

Here it is considered that information does not move in space-time, it moves in physical space only. Physical space itself is immediate information medium between quanta.

Also in the EPR experiment physical space is immediate information medium between elementary particles. There is no information signal in form of photon or some other particle traveling between particles A and B. Time of information transfer between particle A and particle B is zero (4).

## Causality problems for Fermi's two-atom system

Physical space as an "immediate information medium" resolves the causality problem of Fermi two atoms 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 nonzero immediately after  $t=0$ . Implications are discussed"(5).

Excitation probability of  $B$  is nonzero because space in which atoms exists is an "immediate medium of excitation". There is no time needed for information or excitation to pass from  $A$  to  $B$ . Time is only a measure for motion of excitation from atom  $A$  to atom  $B$  in physical space.

## Immediate Physical Phenomena

According to understanding here physical phenomena can be immediate. One can also say "timeless" or "atemporal". Time  $t$  for these phenomena to happen is zero. Experiment from which they conclude that an electron can tunnel through the potential barrier of a He atom in practically no time was carried out recently (6).

An article on arxiv a system of diagrams is introduced that allows the representation of various elements of a quantum circuit, including measurements, in a form which makes no reference to time (hence "atemporal") (7).

## Conclusions

Material change does not run in time, they run in physical space only. Physical space itself is timeless (atemporal). Some physical phenomena that run atemporal physical space are immediate. Time for these phenomena to happen is zero. Clocks are scientific tools which measure time as a duration and numerical order of material change that run in timeless physical space.

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