

TIME IS DERIVED FROM MOTION THROUGH TIMELESS SPACE

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"People like us, who believe in physics, know that the distinction
between past, present, and future is only a stubbornly persistent illusion."

Albert Einstein

<http://rescomp.stanford.edu/~cheshire/EinsteinQuotes.html>

Abstract

Today in physics there are two fundamental approaches to time. The first and most common approach says we use clocks to measure the time component of space-time, space and time being cofounded as the basis of physical reality. However this approach has no experimental support. There is no evidence whatsoever that clocks measure one aspect of space-time, and in truth we cannot observe space-time at all. The second approach says time is cofounded with motion through space. This approach is supported by experiment and observation. We employ clocks to accumulate local internal motion, and then use the result to calibrate duration. This is then employed in the measurement of external motion or material change, and the comparative rate of such change. Our evidence tells us that this rate of change varies with gravity, being commonly known as gravitational time dilation. However we can only measure space and motion, not time, and thus we must assert that the true basis of fundamental reality is space and motion rather than space-time. This means that space itself is in some respect timeless.

Key words: time, space, duration, time dilation, information

Introduction

There is no experimental evidence whatsoever to support the view that space-time exists as the basis of fundamental physical reality. We cannot observe space-time directly, nor can we actually observe a world line, or a light cone. We should remember that space-time is an abstraction, a 3+1 dimensional "mathematical space" devised for ease of calculation. In real experiments we observe motion or the resulting changes in physical space. Space is the arena in which massive bodies move and particles interact. The motion and change is patently observable, we can literally measure a distance, and we can be utterly confident that space exists. We employ clocks to measure duration and we record a sequencing to the motion and the material changes that occur in space. Here time is derived from clocks whose internal mechanisms are themselves in cyclic motion through physical space. Physical space itself is therefore timeless, time is derived from motion through it, and negative motion is an impossibility. Thus travel to the past is out of the question.

Discussion

A growing number of modern researchers are challenging the view that space-time is the fundamental arena of the universe. They point out that it does not correspond to physical reality, and propose "timeless space" as the arena instead. One recent paper on arxiv is *A New Geometric Framework for the Foundations of Quantum Theory and the Role Played by Gravity* (1). Another recent paper says "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). Julian Barbour says in The Nature of Time: "I will not claim that time can be definitely banished from physics; the universe might be infinite, and black holes present some problems for the time picture. Nevertheless, I think it is entirely possible, indeed likely, that time as such plays no role in the universe" (3). Such challenges are nothing new, and go back as far as Aristotle. Even Ernst Mach said: "It is utterly beyond our power to measure the changes of things by time. Quite the contrary, time is an abstraction, at which we arrive by means of the changes of things".

Time and clocks are man-made inventions. Motion is primary, time is secondary. Time is an artifice of measurement, a useful tool that permits us to build mental and mathematical models for our daily lives as well as for our physics and cosmology. But time as a fundamental entity has no role in physics.

Relativity and Time

With a concept of time cofounded with motion rather than space, a new interpretation of relativity emerges. In the Special Theory of Relativity, the rate of clocks and material change is reduced within a fast-moving inertial system. In the General Theory of Relativity, the rate of clocks and material change is similarly reduced within a gravity well. This understanding easily resolves the Twins Paradox. They do not live in time, they live in space. They are made up of atoms and electrons, and as evidenced by pair production and annihilation, they are quite literally "made of light". Each twin might observe reduced local motion in his brother and so reduced ageing, but the twin in the spaceship returns younger than his brother on Earth because his travelling motion through the universe was at the cost of local motion within his body. His reduced rate of local motion was labelled as time dilation, but time is merely a by-product of motion. Clocks "clock up" motion, not time.

Direct Quantum Information

Some research indicates that timeless quantum 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" (4). Here it is considered that information does not move through space-time, but instead moves through space, an immediate medium for identifiable quanta. This is echoed by the concept of a photon as a particle which "experiences no time", long-wave radio reminding us that a photon is an extended entity perhaps 1500m long rather than a point particle. The EPR experiment similarly reminds us that physical space is a timeless environment. There is no discernible signal in the form of a photon travelling between A and B. The time of information transfer between A and B is essentially zero, and we might infer that they are similar extended entities which experience no time.*

Causality problems for Fermi's two-atom system

Physical space as an "immediate information medium" resolves the causality problem of 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" (6). The excitation probability of B is non-zero because the space in which atoms exists is an "immediate medium of excitation". There is no time needed for information or*

excitation to transfer from A to B. Since instantaneous action at a distance remains an uncomfortable concept, we might again infer that A and B are extended entities which experience no time.

Timeless Physical Phenomena

From the above in conjunction with the second approach to time, certain physical phenomena might be said to be timeless, wherein no measurable time can be said to have elapsed. For example within *Attosecond Ionization and Tunneling Delay Time Measurements in Helium* by Eckle et al, a conclusion is drawn wherein "*an electron can tunnel through the potential barrier of a He atom in practically no time*". In similar vein a recent arxiv paper depicts a system of diagrams to represent the various elements of a quantum circuit, in a form which makes no reference to time (8).

Conclusion

When physical objects move, they move through space, not through space-time, and not through time. Time is derived from this motion through space, and space itself is timeless. Whilst the speed of light is considered to be a maximum rate of motion, this varies with the local environment, the photon is an extended entity that experiences no time, and some atomic-scale physical phenomena appear to be timeless. Clocks are macroscopic measuring devices which accumulate local internal motion, and we can record a sequencing of that motion and the changes that occur in space. But we can find no evidence to support the existence of space-time as a fundamental entity. Accordingly we must conclude that we live in a timeless atemporal universe of space and motion, where the past and future only exist in the human mind, and the only eternity is now (9).

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