

Review of: "Philosophical Aspects of Time in Modern Physics"

Richard Sauerheber¹

¹ Palomar College, United States

Potential competing interests: No potential competing interests to declare.

The author describes the historical viewpoints of many others on the concept of time, and the paper is of interest. It appears that much credence is being given to recent ideas that relativity means time is determined by observers and that quantum mechanics somehow proves something about the nature of time. The following comments then need to be considered..

Time is the continuous, irreversible progression of existence (of all entities, including empty space) from the past through the present and toward the future. The entire universe (of matter and nonmaterial entities) exists together at any instant in time and progresses together in time. Even a stationary coordinate in the empty vacuum of space exists in time while time progresses forward. Motion is not required for time to exist.

Special relativity for light is real. That is, light is the only entity with a known total velocity with respect to its own instantaneous coordinate in space, wherever that may be, from which it speeds. All objects with physical mass undergo continuous motion in various directions and have a total velocity, but its magnitude is not known. There is no such thing as special relativity for time. True time is absolute and for any particular event is single-valued, while all measurements of time are relative (not specially relative like light) and subject to error due to methodology or perception (Newton, Sir Isaac, *Mathematical Principles of Natural Philosophy*, in: **Great Books of the Western World**, R. M. Hutchins, editor in chief, **Newton Huygens**, volume 34, University of Chicago, 1952).

The correct original postulates of special relativity for light have been amply confirmed experimentally. The speed of light is fixed in any particular medium at $c = E/B$, which has been found with many methods of measurement, including Hetz using $c = fl$, Michelson using $c = d/t$, and inserting measured values for e and u into the alternative Maxwell formula $c = 1/(\epsilon\mu)^{(1/2)}$. However, sadly, this fact has been misused to claim that time for any event is actually determined by an observer. That is incorrect. Whether one is in a position to observe an event or not, true time for that event is absolute and single-valued for it to occur.

Time is also not determined by clocks or physical matter. Indeed, time existed long before matter ever did. There came a time when the material universe was formed. But like space and God, time is eternal and has no beginning.

Special relativity does not demonstrate or mean that simultaneity is relative. It is not, in spite of wide claims otherwise. Two simultaneous events detected by different observers at different times does not mean the events actually occurred at different times. They can be perceived at different times because of the motion of an observer so that light from the events

must travel different distances to the observer for detection, while the events themselves were nevertheless simultaneous in time.

Time dilation due to motion has been thoroughly disproven, as described in numerous publications from 1963 to 2023. The problem is that the original idea is based on a theoretic system where light is passing a receding rod of length L having a velocity v . The measured time to pass the rod, as computed by an observer on the rod, was claimed to be $t = L/c$. This is the time only if the rod were stationary. The rod is moving, and the correct time is computed by the stationary observer who sees the rod motion from $ct = L + vt$ and $t = L/(c-v)$. The L/c computation is simply a perception error. The idea that it is the actual time for the event has misled many into the idea that true time is actually determined by the motion of one who perceives it. That is simply false. The perception of time, vs. true time, can be very different. In fact, true time is an unknown quantity, like true total velocity for physical objects that have no special relativity like light does.

Quantum mechanics describes the behavior of submicroscopic matter. The motion of all matter, of course, requires intervals of time, but QM does not actually describe the rate at which true time continuously progresses, which is absolute. Physical objects or events, such as counting marbles, assessing energy differences between atomic orbitals, or photons, are quantized, of course. But time is not. Counting marbles from 1, 2, to 3 are whole units or quanta. But counting time from 1 to 2 to 3 units of measure are not quanta but are continuous since time is a continuous variable. There are an infinite number of fractional seconds counting from 1 to 2 seconds, including instants at 1.35 seconds, 2.478 seconds, 1.891 seconds, etc. Time progresses like points on a line, yes, but points on a line are infinitesimal and continuous. One can describe one moment in time or a particular point on a line, either verbally or mathematically, but such a point or instant in time is continuous in the line or in the progression of time. Again, time progresses over intervals that include infinite instants in that interval, not quantized items like photons in a light beam.

QM cannot compute the exact coordinate an electron is at in an atomic orbital cloud, yes. But this does not refute the fact that an electron requires a specific single magnitude of time to reach point B from point A, wherever these positions are that can only be probabilistically estimated.

So the statement that the “now is no part of the time” needs to be explained. The claim that there is no universal time is also unclear. There is a single absolute true time that has elapsed since the universe of matter was formed. It is a universal single value of time but, of course, is not known. There is a single magnitude of time for any particular event, but its magnitude can only be estimated and is not exactly known. Light speed, similarly, is not known in decimal units exactly and instead is estimated currently at $2.99792458... \times 10^8$ m/s. Its exact value is given, though, by $c = E/B$. Like light, the true absolute magnitude of time for a motional event can also only be estimated, but it is given exactly by $t = d/c$. The true distance an object or light actually travels through the vacuum of space or with respect to another object cannot be known, since all planets, stars, and galaxies undergo continuous motion in various directions.

Many claim that time stops at the speed of light and that light does not experience time. This is false. It takes a photon about 8 minutes to reach Earth from the sun and about 1 second from the moon. Others claim that before matter existed, there was no such thing as time because it could not be measured and that time exists only because events happen. That

also is false. Matter does not regulate or determine time. For example, GPS clocks that tick differently when moving fast have been used to argue that matter alters time. But the motion of GPS clocks affects their internal operation, which relies on EM radiation, but true time remains unaltered by the motion of a clock. Events do not control the rate at which time progresses, but of course, all events take time.

A sentence in the paper before section 4 is missing an ending. It ends with experimentally confirmed and.