Time Mechanics

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The presented theory of time is certainly controversial and difficult to accept, but it allows a generalized solution to the problems of modern physics by taking a new look at the phenomenon of the passage of time.

Considering the sequence of physical states, it was found that time does not flow either continuously or evenly; also, there is no relationship between the passage of time and the free movement of bodies, although their distance in time is a measure of their mutual movement.

In the new approach, the phenomenon of universal gravitation has been attributed to the passage of time.

Key words: time, theory of time, time mechanics

> *“However, time does not exist without change, because if our state of thought did not change at all, or if we did not experience these changes, we would not feel the passage of time ... ” Aristotle, Physics, Fr. IV*
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> *“A body is never moved naturally except by another body that touches it and pushes it; after that it continues until it is prevented by another body that touches it. Any other kind of operation on bodies is either miraculous or imaginary.” G. W. Leibniz, Fifth Letter to S. Clarke*

Introduction

The theory of time presented below has no reference to both historical and contemporary understandings of time in physics, which in itself makes this theory controversial. Therefore, for easier acquisition of the theory it is worth temporarily suspending ones acquired knowledge of the basic principles of physics.

In conventional physics, usually the existence and passage of time at all points of the reference system is taken for granted. Time not only flows objectively, but also its passage is continuous, even, and independent of any other properties of the local reference system. The time-measuring axis does not have a specific orientation, but it points constantly to the future that results, for example, from the principles of thermodynamics. Scalar time is rigidly associated with a body’s motion vector through the definition of a measure of motion. Stopping the passage of time would not only stop all movement, but it would also cause the inevitable indeterminacy of all physical quantities related to time.

The present, as a point on the time axis, is shared at every point in the reference system up to infinity; however, as a result of adopting Special Relativity (SR), this rule does not apply to systems in relative motion for which time flows slowly. Any bodies certainly do not meet while in two different places in space, but under SR they always meet while being in two different presents, i.e. distant in time. This is because for them to meet they would have to move relative to each other and time would flow differently for them.

A clock is required to measure time. Each clock, regardless of its construction and use, has at least two components: a free (separated from external influence) oscillating system, and state memory in the form of a calendar. The free oscillating system periodically triggers time-lapse markers, which are not, however, distinguishable from each other. It is only the calendar that makes it possible to distinguish markers, and counting them enables the passage of time to be correctly measured.

Time is usually divided into three types: the past, although this is only in the memory of the Observer; the present, although for it time does not flow; the future, although this is only a conceivable development of the past.

Assumptions[1]

The reference system referred also to hereafter is a natural polar coordinate system with axes, each of which is a half-line anchored in a point observation pole that is identical to the Observer's position and is developed indefinitely in the direction of observation or in the selected reference direction. The coordinates of the reference system are the distance from the pole and the angles between the axes measured at the observation pole. The assumed naturalness of the reference system requires that all its coordinates are non-negative. This construction of the reference system is necessary for the Observer to be associated only with one observation place and the clock assigned to it.

The Observer's reference system is unlimited and covers all bodies in space, and the Observer itself can be tied to any of them. The Observer is always motionless, otherwise its movement would have to be in relation to itself, which is contradictory in itself. The Observer may find that it is moving relative to other bodies, but this is not an observation; however, inference from observations based on accepted principles of physics and geometry by default requires the participation of another Observer.

Observable space which contains moving bodies has a two distinct directions: radial, along which the distance of the body from the Observer is variable and the component of motion is progressive; circumferential, which is constantly perpendicular to the radius of observation, for which the distance from the body to the Observer is constant, and the component of motion is circular.

The Observer moves locally in time and is the holder of the pattern of elapsed time (clock); it is thus the reference for every other present. The present of the reference system is assigned to the observation pole and does not extend directly to the rest of the system.

The centre of the body is further understood as the common point of at least two different axes of inertial (free) rotation of the body.

The possibility of any wave moving in a vacuum is contrary to the concept of wave motion because a wave is a motion of a disturbance of the wave medium, and such a medium in a vacuum is not known. Therefore, it has been assumed that electromagnetic radiation is the movement of a freely oscillating electro-magnetic system (electromagnetic particle) which does not need any medium for movement in space. An electromagnetic particle is not a wave, and its observed wave properties result from the composition of the oscillating motion of the particle and its progressive movement relative to the Observer. These oscillations periodically cause the shape of an electromagnetic particle to change; this results not only in variable collision angles with bodies, but also the observation of a series of seemingly wave-like phenomena in mutual interactions. An electromagnetic particle has no length but only a period of oscillation. The oscillation period of an electromagnetic particle is not associated in any way with its progressive movement, and its measured value depends only on the Observer's clock.

The above assumption, although it is intended to cover every case of observing a wave in a vacuum, serves here to exclude wave–particle duality as an internally contradictory concept.

The separation of bodies is the subject of inference from the theory of time, but until the conclusion was carried out it was assumed that the observed separation of bodies results solely from the resolution of a given observation.

Time Mechanics

Although time itself is considered a physical quantity, its passage is usually understood as the phenomenon of a sequence of physical states of a system that create a cause-and-effect relationship. However, the condition that these states are in any way different from each other is not considered. Thus, it is admitted implicitly that the passage of time is independent of the succession of states, and time flows constantly and evenly.

However, two identical states of a system are not distinguishable and there is no way to indicate the passage of time between them. A clock tied to the system is not reliable here because without experiencing a change in state, a clock simply does not work. A clock outside the system is also not reliable because

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[1] The content uses the conceptual system of conventional physics, while some of the concepts used have been refined, and the others used as closely as possible to their simple semantic layer.

changes in the state of the external system do not affect the state of the local system under consideration. Therefore, it should be assumed that it is a change in the state of the system that is a necessary but also sufficient condition for the passage of time in the system. Due to the lack of a connection between the system state and its change, it is also justified to state that the passage of time consists in the occurrence of mutually distinguishable states of the system.

The only possible physical event that causes a change in the state of the system (body) under consideration is an external collision. The free movement of a body between collisions is an unchanging state that is constantly associated with one and the same present. A collision is a non-transient state, although it causes a change in the state of the system, i.e. the passage of time. The mutual movement of bodies is the primary cause and the necessary – albeit until the collision insufficient – condition for the passage of time.

The passage of time, whose discontinuity is caused by the separation of moving bodies, is random and hence it cannot be assumed that it is even. A local Observer usually accepts the passage of time as continuous and even, because it does not perceive its own invariant states. For a separable Observer with an observed body, the apparent continuity of time is due to the large number of collisions between body parts in relation to the resolution of the observation.

Time Mechanics in the free movement of bodies (Time Kinematics)[2]

For the Observer, all unrelated (separated) bodies can be divided into three sets: approaching, staying at a constant distance, and moving away. This simple division is important for further consideration.

From the point of view of the mechanics of the passage of time, the progressive component of the observed body's movement directed along the observation ray is the most important. The circular component of body movement, which is always perpendicular to the radius, does not change the distance of the body from the Observer, thus it does not affect the possibility of their collision.

The movement of a body is further understood as a change in the position of its centre relative to an Observer moving in time.

The collision changes the path of free movement of the centre of the body, after which the movement becomes free again.

The Observer, like any body, can collide and change its state only with an approaching body, and a body moving away will cannot collide with certainty as long as it moves in a continuous free movement. In the case of approaching bodies, when the observed shape of the path is straight, the collision is certain; for a circle-shaped path, the bodies do not approach each other and collision is impossible. For intermediate directions, the possibility of collision depends on the size of the approaching bodies. Bodies that move freely are not observable. Each observation corresponds to a certain disruption of free movement which results in the shifting of the present of the body and the Observer.

In contrast to the conventional understanding of the role of time in the phenomenon of motion, in the above description the present of the body will move to the next present and time will pass only in the event of a change in the properties of the movement of the body caused by the collision. The movement of a separable body in space does not depend on the movement of the Observer in time and is always free. In conventional physics, the present is infinitely short, and in Time Mechanics the present of a body in free motion stretches between collisions.

In general, a body that is unable to move freely in space collides and changes the properties of its movement, thus shifting in time. A series of these shifts gives the passage of time.

The presents of all bodies approaching the Observer are in its future because they may change its state and shift it in time by a collision. Approaching the body is a necessary condition, though it is not sufficient for a collision. Bodies that move away certainly cannot change the state of the Observer, hence their presents are in the Observer's past. The present of bodies in motion are distant in time from the present of the Observer, and this distance, which has a magnitude, orientation, and sense, is a vector. For bodies

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[2] The paper contains the informal assumption that physically heterogeneous quantities calculus exclude at least non-commutative operations. The above assumption results in the rejection of Euler's postulate.

approaching the Observer, this vector was assumed to be positive because the present of the body is in the future of the Observer, at least until it collides with it or passes by.

When a body collides with the Observer, they both move in time depending on their inertia and the distance between them in time. Collisions, and thus the passage of time in the observed system, do not change the distance in time of the centre of the system of colliding bodies from any separate Observer, and thus have no effect on the path of movement of the centre of the system observed by it. This means that the resultant vector of the time-shift vectors of the centres of bodies relative to the centre of the system is zero-magnitude. Any Observer who is tied with the centre of a separable, free system of bodies remains at a constant time distance to another centre of any free system of bodies, and this distance is a measure of their mutual movement.

Momentum is the product of the measure of body inertia and distance in time; it has a non-zero value only for bodies distant in time from the Observer. For any separate system of bodies, the resultant vector of their momentum relative to the centre of the system is constant.

The generalization of considerations on the centres of body systems results from the principle of conservation of momentum relative to the Observer. The passage of an Observer's time does not affect the free movement of the centre of any chosen body system, and this movement will change only as a result of a collision with a body outside the observed system. The observed path and momentum of the body are different for Observers that are distant in time. The Observer's movement in time is discrete, and at the same moment it observes the continuous free movement of the body, so it happens that the Observer stays in the permanent present, i.e. time does not flow for it and the body moves beyond observation and time.

It follows from the above that the distance in time between the centre of a separable body and the pole of the reference system is constant, regardless of the passage of time by the Observer, because separated bodies do not have mutual influence on the momentum and position of their centres. However, the passage of time of the Observer affects the observation itself.

As a result of the time shift of the Observer from one present to the next, the observed body motion vector changes. Due to the constant distance in time between them that results from the principle of conservation of momentum relative to the Observer, the composition of a body movement and time shifts of the Observer causes the observed curvature of the body movement path. Since the shape of the body's path between observations is unknown, it can be assumed that it consists of a number of straight sections that correspond to the Observer's shifts in time. The segments form a broken line that leads, along with the increasing resolution of observations in relation to time shifts, to the form of a conic curve. Depending on the direction of the resultant movement relative to the Observer, the observed shape of the free body path is between the straight line for which the total time of the Observer is deposited on the body moving along the observation radius, and the circle for which the passage of the time of the Observer does not affect the distance of the body in time. If there is no progressive component of free mutual movement, the distance between the bodies in space is constant; the distance in time is zero, and the centres of the bodies are constantly in the same present. This is not equivalent to the disappearance of the circular component and changes in the angle of observation, except that the body moves around the Observer.

The observed shapes of the free movement paths of a body are described in the reference system by the polar equation of the conic curve in explicit form. Depending on the value of the eccentric, it is an open curve for progressive movement and is closed for circular periodic movement.

Simply put, the observed shape of the free motion path of the body is the result of the composition of the free motion components of the body in space and the Observer's movement in time.

Generalizing the above considerations, it can be stated that the distance in time of a free-moving body from the observation pole is constant and measures the body's movement. The above statement is the basic law of Time Mechanics.

In conventional physics, where time always flows, the laws of motion require the assumption of immaterial interaction between bodies that transfers time dependence and curving paths of motion of bodies.

Time Kinematics considers two cases of a body in space in which it does not move in time. The first, when a body also does not move in space (1), occurs for the centre of each body that is separated from the Observer and which constantly shares the present with the pole of observation. Time Kinematics also describes the second case, when there is no movement in time, but the body moves in space (2). This case covers the centres of all bodies that move freely.

Time Mechanics in the movement of tied bodies - universal gravity (Time Dynamics)

In the classic experiment with colliding balls that illustrates the principle of conservation of momentum, descriptions of which are probably found in every physics textbook, the question of the location of the event Observer is dealt with. The Observer is not tied to any of the balls, so it must be tied to another implicitly introduced body. There is an interesting justification for the need to use a strange construction in which an unnecessary body is introduced instead of tying the Observer to any of the balls. An Observer tied to one of the balls as a result of a collision would not change position and its zero value of momentum, and only a moving ball would experience a total change of momentum. Thus, despite the collision with the ball, the Observer would not experience any change of state. Time Dynamics considers such an event when, as a result of a collision between a body and an Observer, the consequence of a change in the properties of body movement in space is movement in time.

Time Mechanics considers four possible cases of mutual movement of a body in space and an Observer in time. Two cases in which there is no mutual movement in time have been described above as belonging to Time Kinematics. If one always remembers that two phenomena, one of which is not continuous, are subject to assembly, and the separation of bodies depends on the resolution of observation, it is possible to describe the other two cases contained within the scope of Time Dynamics. The first is movement that takes place only in time (3). Such movement is carried out by each Observer.

As a result of collisions, the Observer moves in time without moving in space, because, as previously stated, movement in space would have to be relative to itself, which is contradictory. Collisions limit the free movement of a body's particles in space, but not in time, which the stationary Observer experiences as mutual attraction, called universal gravity. The motionlessness of a gravitating body applies only to its centre and in relation to its particles is ostensible; this results from not perceiving the single motions whose distance travelled between collisions is below the linear resolution of observation. Universal gravitation is a symptom of the passage of time, and the unidirectionality of both phenomena is not accidental.

The last considered case of movements in space and time is the occurrence of these movements together (4). This case applies to body components that are tied with the Observer and are in motion.

Weightlessness is a property of bodies in free movement because there is no observable inertia of a body that does not change its distance in time. In a tied movement, the weight of the bodies is measured by their inertia and the change of distance in time. Weight as the inertia of a body moving in time is equivalent to changing its momentum.

Generally speaking, movement in space is free, while movement in time is tied. Tied bodies are those whose distance in time is variable. Hence, separable bodies can be described as moving freely, for which the distance in time of their centres remains constant.

With nothing to collide with, a body will not experience the passage of time. If the movement of a body in time ceases to be supported by collisions, then according to the principle of momentum conservation the body will continue to move freely in space, and the total momentum of the system will not change, even if it has been previously dispersed into many bodies.

The rotational motion of a body is a periodic motion in both space and time, but the centre of a rotating body does not change its position in time relative to an external Observer. The rotational movement of a body is a tied movement, but circling bodies are separable and move freely outside of time.

Final considerations and conclusions

For an Observer on an appropriate scale, time is a certain statistic. In physics, statistics of the passage of time such as temperature and heat are commonly used. Temperature allows the local variability of the passage of time to be estimated and compared; heat allows the size and distribution of the time stream of related bodies to be estimated. Universal gravity is, in this approach, a generalized collision that lasts as long as body temperature is non-zero and time passes.

With relatively low resolution and the required accuracy of observation, the continuous motion of bodies allows the local use of continuous quantity calculations to describe the phenomena. However, due to the unlimited accuracy of mathematical models of continuous quantities, omitting the reference to the scale in the description of events results in a discrepancy between a description and observations when the discontinuities and irregularities of the passage of time become significant enough. This was why the classic continuous description of the properties of bodies on an atomic scale had to be abandoned in favour of quantum mechanics.

In a real clock, the oscillating system is not completely free because the triggering of the time marker, by dissipating the momentum of the oscillating system outside, causes the oscillator frequency to slow down. In order for the clock not to be late or stop, even a very small loss of momentum must be compensated for by an external source, and the indications must be corrected using another more accurate clock. The Observer, by changing the ambient temperature of the clock, determines the average number of collisions per observation period and, thus, the clock's course. Judging by the properties of real clocks, for a homeothermic Observer, time flows relatively evenly, locally and on an appropriate scale. However, the discontinuity of time makes it impossible to build a time-measuring device of any resolution and all clocks are 'ticking'.

The Observer has a certain degree of complexity that is necessary for local time to flow and for the possibility of observation. Any observation changes the state of the Observer, but this does not yet allow measurement. Not only a clock but also an event register is necessary for the measurement because each measurement requires a comparison of at least two values. If the movement of the Observer in time does not change the state of the special property of a certain area of the body, then this area does not move in time relative to the observation pole, and this property may constitute the Observer's memory.

The Observer can only measure body properties by collision. Each collision is perfectly elastic, i.e. not transient, although the relatively low resolution of observations may justify inferring the 'plasticity' of the collision of complex bodies. A collision with a relatively large body changes the state of the body and the Observer so much that the measurement is burdened with a large error and is therefore useless. Therefore, there is a need to use a carrier that contains data about the observed body with which the collision causes both a relatively small change in the state of the body itself as a result of radiation or reflection, as well as a slight disturbance in the Observer's movement in time as a result of measurement. Certainly, the best choice of such a carrier is an electromagnetic particle.

The distance of a body in time, and thus the then value of its movement relative to the Observer, can be determined indirectly as the difference Δt between the oscillation period of the electromagnetic particle radiated by the source tied to the observed body T_s, and the oscillation period of the electromagnetic particle, with the appropriate spectral line, radiated from the reference source not far in time from Observer T_o, hence $\Delta t = T_o - T_s$. This quantity, together with the direction of observation, is a vector $\overrightarrow{\Delta t}$ of body movement relative to the Observer.

A simple but significant example to describe according to the principles of Time Mechanics is the movement of an elevator relative to an Observer that is tied to the centre of the Earth. When standing on the floor, an elevator weighs fully and moves only in time (3); however, when it is being pulled by a rope between floors, it moves in time and in space with varying weight (4); when it is falling, it moves only in space, experiencing weightlessness (2). The above three cases are described outside of Time Mechanics, assuming the existence of an immaterial interaction between the elevator and the Earth. However, there is a case to be considered in which the bodies do not move each other in time and space (1). This case occurs for bodies that constantly share the same present, and such a body relative to the centre of the Earth will be an elevator lowered from an orbital station. In this case, the descriptions and explanations of the experiment become divergent. In conventional physics, a rope connecting the elevator to the station will be constantly taut due to the gravitational effect of the Earth, which increases with the square of the decreasing distance, and the elevator and the station will finally fall to Earth. In Time Mechanics, an unwound rope will hang loosely, and the elevator will not move away from the station; it will move the same way as the station, i.e. in a free circular motion relative to the centre of the Earth.

The theory of time presented above is certainly not complete, but it seems to be a justified attempt to create a general solution to the problems of modern physics by taking a new look at the phenomenon of the passage of time.