

Mass as a Fundamental Parameter and Time as a Dependent Parameter in Physical Systems Nine Supporting Arguments and Considerations

Gh. Saleh 

Saleh Research Centre, Netherlands

One of the fundamental questions in the understanding of the universe concerns which physical quantities should be regarded as fundamental elements in the description of nature, and which quantities serve as descriptive tools or dependent parameters.

Mass and time are among the most important quantities in physics. Mass plays a role in the description of the inertia of bodies, gravitation and the mass-energy relation. Time, in turn, is used for determining the order of events, measuring the duration of motions and expressing the evolution of physical systems.

Despite the important role of both quantities, the question may be raised as to whether time should be regarded as a fundamental and independent quantity, or whether it may instead be defined within a different framework, with emphasis placed on physical changes. Whether observation of changes in the universe leads to the concept of time, or whether time itself constitutes one of the elements necessary for the description of such changes, remains to be examined [1, 2]

In this paper, a proposed perspective is examined according to which mass occupies a more fundamental position, and time may be regarded as a parameter dependent upon physical changes and processes. Nine principal arguments supporting this perspective are presented below, with fresh exposition and more extensive explanation.

1. The Distinction between the Direct Experience of Mass and the Concept of Time

Mass and time differ in their manner of experience and measurement. An object may be seen, touched, weighed and, using appropriate instruments, its mass determined. Time, by contrast, cannot be held like an object or observed directly. The passage of time is recognised through clocks, changes in the position of objects, heartbeat, oscillations, chemical reactions and other measurable processes [3].

2. The Role of Measurable Changes in the Recognition of the Passage of Time

Change constitutes one of the most important means through which the passage of time is recognised. Change of position, alteration of the state of matter, chemical reactions, the growth of living organisms and the evolution of celestial objects all constitute examples of processes that may be examined and compared with one another.

A hypothetical question may be raised in this context: the absence of any event, together with the absence of change in any measurable property of the universe, would render distinction between two moments impossible. Under such circumstances, empirical recognition of the passage of time would



encounter a fundamental difficulty, since no process would be available for comparison of a prior and a subsequent state.

3. The Diversity of the Properties of Mass Compared with the Nature of Time as a Quantity

Matter may exist in various states, such as solid, liquid and gas, and possesses properties such as density, hardness, elasticity, conductivity and mechanical strength. These properties are measurable and undergo alteration with changes in temperature, pressure, chemical composition or the structure of the matter.

For example, a given substance may be solid at a particular temperature, undergoing transformation into a liquid state with increasing temperature. Its density, too, may increase or decrease as a result of changes in environmental conditions. Such transformations demonstrate that material systems possess diverse and examinable properties.

Time, by contrast, possesses no states such as solid or liquid, and cannot be transformed from one physical state to another in the manner of matter. In physics, time is generally defined as a quantity for specifying events and measuring the temporal interval between them. This distinction may constitute a motivation for examining the conceptual status of time.

4. The Direct Role of Mass in Describing Physical Behaviour and the Measurement Role of Time

Mass plays an essential role in many physical relations. In Newtonian mechanics, inertial mass is associated with the resistance of a body to changes in speed. Mass is, furthermore, of importance in the calculation of momentum, kinetic energy and the gravitational behaviour of bodies.

For example, under classical conditions, the net force exerted on a body is related to its mass and acceleration. Mass likewise appears in the kinetic energy relation and plays an important role in the examination of collisions, the motion of bodies and the stability of mechanical systems.

Time likewise possesses a fundamental application within these same relations. Speed is defined as the change of position with respect to time, acceleration as the change of speed with respect to time, and power as the quantity of energy transferred per unit time. Time is therefore not merely an arbitrary and inconsequential counter, but plays a role within the mathematical structure of physical theories.

The question therefore arises as to whether a deeper definition or interpretation of time may be proposed, one associating it without dependence upon physical processes and measurable changes. The answer to this question is negative.

5. Does the Concept of Time Retain Meaning in the Absence of Mass?

One of the principal questions raised by this perspective concerns the meaningfulness of time in a hypothetical universe devoid of mass or matter.

This question may be examined from the perspective that the measurement of time requires the existence of a clock or process by means of which the temporal interval between events may be



determined. The absence of any physical system and any measurable process renders the practical definition of time impossible.

6. The Effect of Changes in Mass and Energy on Other Physical Quantities

Physical changes may affect numerous quantities. In nuclear reactions, a portion of the difference in rest mass between initial and final systems is associated with a change in energy. In processes of energy absorption or emission, likewise, the energy state of the system undergoes change, and this change is of importance in its physical description.

By contrast, a change in the value of time alone does not resemble the application of force to a body. The elapse of one second, for example, does not in itself constitute the mechanical cause of the motion of a body.

7. Reconsideration of Classical Conceptions and New Theories about Time

According to Newtonian mechanics, time is regarded as an absolute quantity, flowing uniformly independent of motion and of the observer. This assumption provides a very good approximation in many everyday and engineering problems.

With the development of physics, the special theory of relativity demonstrated that measurement of the temporal interval between events may depend upon the state of motion of the observer. In general relativity, likewise, the structure of spacetime is related to the distribution of matter and energy, with gravitation described within the framework of spacetime geometry.

These theories do not signify the abandonment of Newtonian physics within its domain of application; rather, they demonstrate that classical mechanics constitutes a suitable approximation under specified conditions, while a more precise description is required under other conditions.

This historical development may constitute a motivation for reconsideration of the concepts of mass and time. This matter may be regarded as an invitation to the critical examination of the theoretical foundations of physics.

8. The Dependence of Time Measurement upon Regular Physical Processes

Clocks measure time using repeatable physical processes. In atomic clocks, specific transitions between the energy states of atoms form the basis for the precise definition and measurement of time. In mechanical clocks, likewise, the periodic motion of a mechanism is employed for counting temporal intervals.

These examples demonstrate that the measurement of time invariably relies upon a physical process. Determination of time requires the counting of an event or cycle, together with its comparison against a defined standard.

9. The Distinction between Physical Reality, Measurement and Mathematical Model

In physics, distinction must be drawn between a natural phenomenon, the method by which it is measured, and the model employed for its description. Mass is measured by means of specific



instruments and methods. Time, likewise, is measured by clocks operating on the basis of regular physical processes.

References:

- [1] Saleh, Gh. “A New Explanation for the Existence of Ultimate Limits of Space, Mass, Time, and Speed in the Universe.” Saleh Theory, 14 Jun. 2025, <https://www.saleh-theory.com/article/a-new-explanation-for-the-existence-of-ultimate-limits-of-space-mass-time-and-speed-in-the-universe>
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- [3] Saleh, Gh. “Mass as a Primary and Time as a Dependent Parameter in Physical Systems: 7 Supporting Arguments.” Saleh Theory, 19 Jul. 2025, <https://saleh-theory.com/article/mass-as-a-primary-and-time-as-a-dependent-parameter-in-physical-systems-7-supporting-arguments>

