5.1 THE NOTION OF TIME

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Observing a physical phenomenon in the small neighborhood of a point $q \in M^{\mathrm{Re}}$[1], which proceeds in the form of oscillation, we can introduce the notion of time.

It will do for the purpose to create a sequence of consecutive values of observables $z_1, z_2, z_3, \ldots, z_k$ where $\underset{i \in \{0,1,2,\ldots\}}{\forall} z_i \approx z_0$.

Let us note that the sequence $z_i(\overset{k}{\times} TU)$ depends on the geometry of differential submanifold $U \subset M^{\mathrm{Re}}$ in the neighborhood of point q, as emphasized by dependence on the tangent bundle of submanifold U .

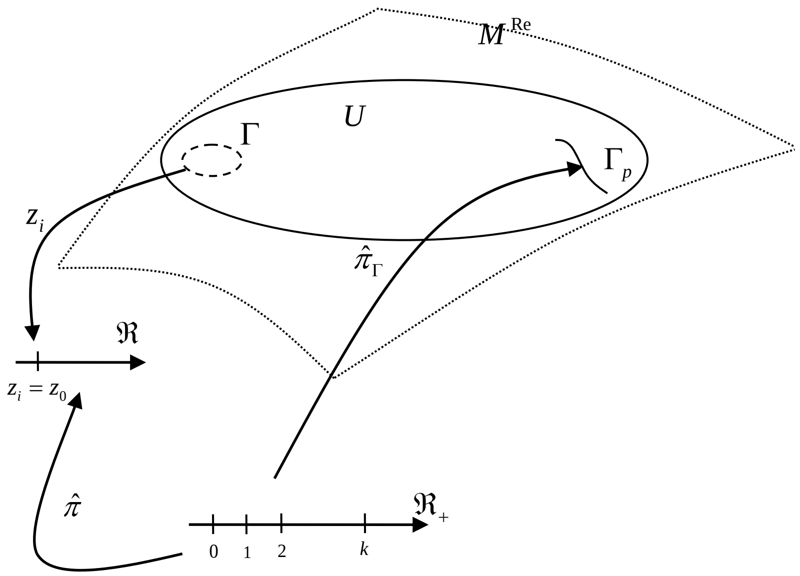
It will do for the purpose to the consecutive values of the sequence z_i, to assign unambiguously, ordered pairs (i, iz_i).

Then the sequence of ordered pairs (i, iz_i) is regarded as a subset of the graph of mapping of a piecewise linear $\hat{\pi}$ from the set of positive real numbers $\Re_+$ to the set of real numbers $\Re$:

$$\hat{\pi} : \Re_+ \rightarrow \Re$$

It is assumed that the mapping of $\hat{\pi}$ is linear between consecutive points of graph (k, kz_k) and $(k+1, (k+1)z_{k+1})$, where $k \in \{0,1,2,\ldots\}$.

[1] M^{Re} is a smooth differential manifold, describing a real physical space.



The domain of a parameterizing map will be referred to as time.
Let us note that the resulting map $\hat{\pi}$ depends also on the geometry of the submanifold U which is written as follows:

$$\hat{\pi}(\overset{k}{\times} TU) : \Re_+ \to \Re$$

Based on the mapping introduced $\hat{\pi}$ we can parameterize other physical phenomena, for instance, an object moving along the curve Γ_p using mapping $\hat{\pi}_\Gamma \circ \hat{\pi}^{-1}$, or directly using mapping $\hat{\pi}_\Gamma$.

Let us now consider the same physical phenomenon with a repeated value of observables in two different local coordinate systems B and C, with a defined constant gravitational field intensity $\vec{\gamma}^B$ and $\vec{\gamma}^C$:

$$\vec{\gamma}^B(q_1, q_2, q_3) = const^B >> const^C = \vec{\gamma}^C(q_1, q_2, q_3)$$

Comparing the dynamics of the same phenomenon which occurs in systems B and C we find that it proceeds at a much slower rate in system C. One could argue and maintain that the reason for the different dynamics of the phenomenon in system C is that time runs at a slower rate. However, this explanation contradicts the structure of the notion of time as presented above[2].

To avoid this type of contradiction, we will assume that the reason for the different dynamics of phenomena in systems B and C is that the properties of space are different; from now on, space will be considered as being non-homogeneous and anisotropic. In addition, the non-homogeneity of space is a consequence of differences in the distance τ between boundary hypersurfaces, whereas anisotropy of space results from the variable angle between the normals to boundary hypersurfaces[3].

Summing up, we can say that, when comparing the same physical phenomena in two different frames of reference (not only inertial), we are able to characterize the space in which such phenomena occur.

Using the observation referred to above, we will equate time with the properties of space, which determine changes in the values of observables according to the definition:

Definition
Local time, defined in a given region of space, is the property of space which defines the dynamics of changes of the observables of objects which can be differentiated in that area.

Directly from the definition, it follows that a lack of lapse of time in a specified region of space means, for the objects contained therein, that their observables will not change at all. What remains is the question whether such regions of space exist at all.

Also from the definition it follows that mapping $\hat{\pi}$ depends on the parameters

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[2] Let us consider one simple experiment with two identical balls made of iron falling down in two different liquids (for example water and waterglass, which is also called sodium silicate).

As we can expect, after releasing two balls simultaneously from the same height to measuring cylinders containing various liquids we observe different velocities of the balls (in measuring cylinder containing waterglass velocity of a ball will be lesser then in second one and depending on concentration of watergalss).

Now we compare these two liquids with two different regions of space in which different gravitational field strengths occur. Of course instead of falling balls in these two different regions of space, we can observe transition between the two hyperfine levels of the ground state of the caesium-133 atom.

Conclusion from an experiment is obvious; different lapse of time depends on properties of space.

Nevertheless, nobody will say that the reason of observed different dynamic of phenomena in two different liquids is different lapse of time.

It is a matter of correct distinguishment between cause and effect.

[3] See: the asymmetry vector.

$$\tau_i : \overset{n(i)}{\times} TU -> \overset{m(i)}{\times} \Re$$

In a given local coordinate system, the parameters τ_i determine the properties of space; this can be written formally as follows: $\hat{\pi}(\tau_1, \tau_2, ..., \tau_k)$.

Known parameters τ_i are the distance τ between boundary hypersurfaces, vector of asymmetry of mirror spaces ${}^{\alpha\beta}\vec{\xi}$, tensor of elasticity ${}^{\beta}K$ of boundary hypersurface ${}^{\beta}\aleph$, and tensor of elasticity ${}^{\alpha}K$ of boundary hypersurface ${}^{\alpha}\aleph$.

5.2 PARAMETERIZATION OF DIFFERENTIAL MANIFOLD M^{Re} VS. UTTER TIME

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Differential manifold M^{Re}, which describes a real physical space, changes in time. Such changes may be grasped by taking into consideration its variability parameter which may be referred to as utter time and denoted by the symbol t^U [4].

Let us now consider two distant coordinate systems to realize that there is a difference between local time and utter time. In such systems, there is a well defined local time which parameterizes processes that occur in such systems. However, for proceeding to parameterization in both systems by means of a single time axis, it is necessary to determine the sequence of processes, including the simultaneity of events, which is practically unfeasible.

Nonetheless, it should be emphasized that, in theory, it is possible to parameterize evolution in the time of manifold M^{Re}.

Let us now introduce the notion of absolute time:

Definition
Absolute time is the time lapsing in a region of space with a strictly defined distance between mirror spaces, which is 0,894 μm, applied to the parameterization of phenomena in a freely localized, small set U, comprised in M^{Re}.

Moreover, let us explain that from the point of view of the Theory of Space, what is referred to as the twin paradox does not exist if the twins are in systems where gravitational intensity is the same. Obviously, the time required for the acceleration of the rocket and for maneuvers, if any, is an exception. In addition, the forces of inertia being exerted at that time will further be equated with forces of gravitation[5].

Good clocks for the twins would be those calibrated in absolute time units, as they would show an exactly same time after being synchronized just once.

Summing up, a twin in whose system the average gravitational intensity was higher will be older because of the faster lapse of local time – later on

[4] The first letter of 'utter'.
[5] This can be done, equating inert mass with gravitational mass, same as A. Einstein did. From the point of view of the Theory of Space, in a system which is moving in an accelerated motion, the distance between boundary hypersurfaces is decreased and their orientations are changed so that they cease to be parallel to each other.

it will show that time runs faster in regions with higher gravitational intensity. However, age differences between the twins would not be as significant as those referred to in the Special Theory of Relativity[6]. Moreover, in contrast to both the Special and General Theories of Relativity by A. Einstein, it is possible to say without any doubt which of the twins will be older.

[6] In the "Theory of Space" time transformation for inertial systems is identity $t' = t$ - please see chapters 5.3 and 5.4 in which you will find the reason of erroneous interpretation of Lorentz transformation and so-called contraction of length and time dilation.