Time Dimensions

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ABSTRACT: The works saying that the number of time dimensions in the space-time may be bigger than one have been analyzed. One has stated that in this case my results from my earlier work [1] are valid too. It concerns to my statement that time is as if "a newcomer from another world" and that time is a generalized field of charges and interactions.

Although the majority of works suggest that there is only one time dimension in each space-time, there are works saying that quantum consistency of the superstring requires the 10-dimensional space-time, but not necessarily the usual (9,1) signature, but there are possible signatures (9,1), (5,5), (1,9) or (10,2), (6,6), (2,10) [2].
So, there may be more than one time dimension. So we have n equations (n – the number of time dimensions)

$$\frac{dQ}{dt_i} = J_i$$

$$i = 1, \dots n$$

and we have n fields of charges and interactions so as n time dimensions equivalent to these fields.
We have simply the stratification of time and the multiplication of fields, currents and charges equivalent to the time.
In the case of Special Relativity we have:

$$ds^2 = \sum_{i=1}^{m} x_i^2 - \sum_{i=1}^{n} c^2\, t_i^2$$

$n + m = D$ - dimension of the space-time

Again, after the passage to the perpendicular axes and the reduction to them we obtain the root:

$$ds = \sum_{i=1}^{m} x_i - k \sum_{i=1}^{n} c\, t_i$$

k - complex unit.

We have assumed the perpendicularity of all coordinates. We can do it at least locally.

Discussion:

- Again we have the situation when $ds^2 < 0$ for certain regions and the complex coordinates appear
- The complex unit j determinates every time dimension which (similarly to the single time dimension) is "the newcomer from another world".

We have:

$$\frac{dQ}{dt_j} = J_j\,(x_i \ldots x_{i-n})$$

n - the number of space dimensions
$i \geq n$ - the number of dimension

$$Q = \int J_j\,(x_i \ldots x_{i-n})\,dt_j = J_{0j} \int f(x_i \ldots x_{i-n})\,dt_j = J_{0j}\,T_j$$

The integral constant is equal zero [1].
T_j - time in the curved space-time after absorption f.

The considerations in the space containing the curved space may be led analogically for every time dimension. The time is again the generalized field of charges and interactions.

References:

[1] Z. Morawski, "Attempt at Nature of Time", this website
[2] M. B. Blencove, M. J. Duff, Nuclear Physics B 310 (1988), p. 387-404