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Special Relativity and the Universe evolution

1. Introduction

As is well known, according to Special Relativity (SR) a transition from an immovable reference system to any moving one may by interpreted as some *rotation in the Minkowski space*. Moreover, the *translations* are used in such space, that is the main subject of the paper. But firstly we will briefly remind some aspects of a rotation in an *pseudoeuclidian* space.

Unfortunately, *the imaginary angle* rotation correct geometrical interpretation is very seldom in the training courses on the SR, and it differs from usual Euclidean real angle rotation. In fact, when we come from an immovable reference system to any moving one, *the time axis turns* on the angle depending on velocity, and the light world line must stay the bisectrix. Therefore, the space axis also *turns on the same angle* (see **[Taylor, and Wheeler, 1966])**. The world line of a light flash is shown as a dotted line in the Figure 1. A moving reference frame is also shown as it will be present in the immovable reference system. So, this moving reference frame doesn't stay rectangle, it seems to be an *oblique* frame!

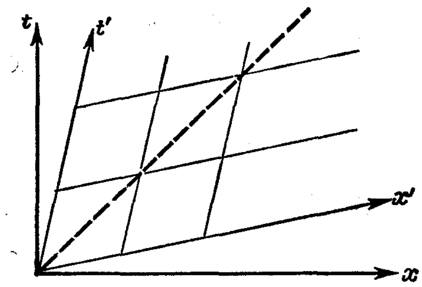

Figure 1. A moving system reference in an immovable one **[Taylor, and Wheeler, 1966]**

To take into account the past and the inverse motion, we have to continue the time and spatial axis through zero.

When we change an angle of rotation the scale of the moving coordinate reference frame changes too. The more this angle value, the more this scale becomes longer (or time and space distances seem to be shorter).

So, to come from one inertial reference frame to the other we use the Lorenz transformation, that is a rotation in a 4D pseudo Euclidean space. Such transformations constitute the Lorenz group which includes rotations in three purely spatial and three time-spatial planes.

Meanwhile, the more large transformation group exists in this space, named Poincaret group. It contains not only rotations (Lorenz group), but also time and spatial translations. Therefore, the Poincaret group is specified by 10 parameters. A linear differential operator (generator) may be used for each of 6 rotations and 4 translation, giving a small deviation of a vector when a corresponding transformation parameter (rotation angle or translation value) has a small fluctuation. These *mathematical* operators are proportional to the *basic physical* operators (angular momentum, velocity, pulse, and energy). This is a base for the link between the corresponding conservation laws and the Minkowski space symmetry relative to rotations and translations.

2. SR and the World chronological evolution

For parallel translation in time (Poincaret translation) it seems to be the only one of its kind as a self-mapping of all 4-events that correspond with a shift of time zero point. In this case we have a light cones family (coming from a spatial point), that is shown on the figure 2. In the course of time the points of one cone (for example, s1) become to the points of the next points (for example, s2), these points belong to the same time vertical line (for example, passing coordinate x1).

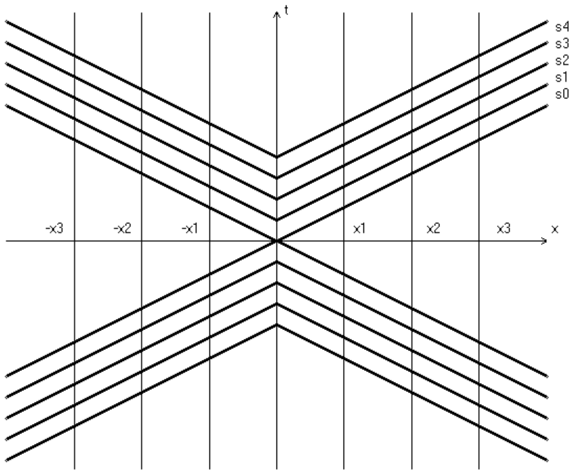

Figure 2. A light cones family corresponding with Poincaret translation

But this chronological evolution model is not solely possible, and it doesn't meet the relativistic invariance condition (that is the more important). In fact, when we choice another reference system, the line passing coordinate x1 will not parallel the new time axis. Besides, the new distances along the new time axis between light cones will not equal to the old ones. Therefore, two selected geometric families (light lines and vertical lines) don't permit to invariantly parametrize all the set of 4D events, i.e. their *real* evolution in time.

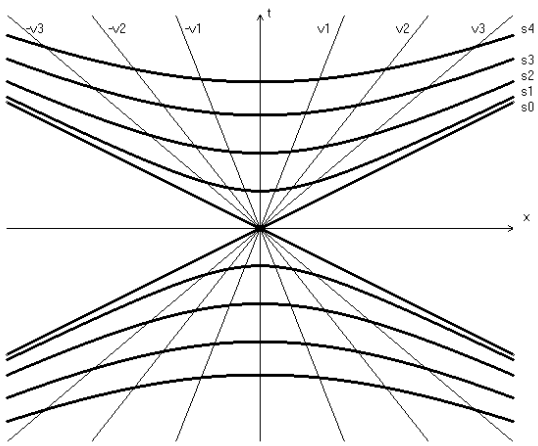

Figure 3. A light cones family corresponding with E-translation

To obey the relativistic invariance conditions we have to choice another time-space frame (see fig. 3). As it is known, when we use any Lorenz transformation only hypersurfaces family

$$t^2c^2 - r^2 = const$$

is invariant, and their mutual distances along time axis stay the sames in each reference system. Further, any line position that connects the point of origin with a given 4D point also is invariant in each reference system. Really, we found the Lorenz invariant system frame[1]! The same manner we may parametrize the spacelike area outside initial light cone, but we will not do it here.

In fact, we also determined some evolution of 4D events at any translation along the time axis. Actually, if the distances between all selected hypersurfaces along the time axis are equal one to another, then their projections to the time axis (in each reference system) will be equal too. So, we have the right to determine such *new* type of the time translation, the points of a hypersurface just become to the corresponding points of another surface, like to “quasiparallel” shift of these surfaces! I propose use the term “E-translation” for this “chronological” operator that realizes such evolutional shift (from the “evolution” or from “Einstein”).

This E-translation *doesn’t determine* a parallel translation along the time axis in any *casual* system reference. In essence, it determines an *interval* shift in the Minkowski space. Further, all the spatial translations and all the rotation must be determined in any 4D point not for casual system reference, but relative to the corresponding hypersurface, and to the corresponding velocity direction. In the aggregate all these modified transformation form the new 10-parameters E-group (a closed operation set), and lead to the corresponding generators. Particularly, *energy E-operator* corresponds with a Minkowski space symmetry along *to a given inertial motion word line*, not along to a *casual* time axis.

BIBLIOGRAPHY

[Taylor, and Wheeler, 1966] E. F. Taylor, J. A. Wheeler, *Spacetime Physics*, W. H. Freeman and Company, San Francisco and London, 1966.

[1] Such the hypersurfaces correspond to the Rindler observers coordinates (see, for example, http://en.wikipedia.org/wiki/Rindler_space).