JOURNAL OF SCIENCE OF THE HIROSHIMA UNIVERSITY, SER. A, VOL. 17, NO. 1, AUG., 1953

Some Results Deduced from the New Fundamental Group of Transformations in Special Relativity and Quantum Mechanics.

By

Takashi SHIBATA

(Received March 7, 1953)

§1. Character of the new fundamental group of transformations.

In the previous paper [1], we have shown that the special Lorentz transformations are available only in the case where the properties under consideration are assumed to be spherically symmetric. In the case where it is not assumed whether the properties considered are spherically symmetric or not, a new fundamental group of transformations should be taken in place of special Lorentz transformations, as representing the relations between the coordinates of two systems one of which is moving with uniform velocity to the other. Such a new fundamental group of transformations has been searched in the previous paper [2]. The form of the equations of the transformations of this group, has been given by the expression (1.2) of the previous paper [3], as follows

$$\begin{aligned} x'^i &= x^j\left[\delta^i_j - \frac{d^i-u^i/c}{1-(du)/c}\,d_j - d^i\left\{\frac{u_j/c}{\sqrt{1-(uu)/c^2}} - \frac{d_j\sqrt{1-(uu)/c^2}}{1-(du)/c}\right\}\right] \\ &\quad + t\left[d^i\,\frac{(uu)/c-(du)\{1-\sqrt{1-(uu)/c^2}\}}{\{1-(du)/c\}\sqrt{1-(uu)/c^2}} - \frac{u^i}{1-(du)/c}\right], \\ t' &= [t-(ux)/c^2]\Big/\sqrt{1-(uu)/c^2} \qquad (i,j=1,2,3) \end{aligned} \tag{1.1}$$

the notations which appear in the expression, being explained there.

The essential difference between the transformations (1.1) and the special Lorentz transformations, is that the former transformations (1.1) contains constants d_1, d_2, d_3 which are considered as representing the direction cosines of certain direction because of $(dd)=1$. Thus by the new fundamental group of transformations, certain direction whose direction cosines are d_1, d_2, d_3, is introduced. Concerning such a direction determined by the direction cosines d_1, d_2, d_3, we can show that the following statements hold.