

***The "Lorentz Transformations Without Rotation" and
The New Fundamental Group of Transformations
in Special Relativity and Quantum Mechanics.***

By

Takashi SHIBATA

(Received Dec. 20, 1954)

Introduction and Summary.

In the previous papers [1, 2], we have proposed to replace the "Lorentz transformations without rotation" by the new fundamental group of transformations, as representing the relations between the coordinates in two inertial systems one of which is moving with uniform velocity to the other. In this paper we shall investigate some property of the new fundamental group of transformations comparing with the "Lorentz transformations without rotation". In § 1, we shall state the character of the "Lorentz transformations without rotation" and the new fundamental group of transformations, and then show that the transformation of the new fundamental group is obtained by means of a suitable combination of the "Lorentz transformation without rotation" together with certain spatial rotation. The explicit expression of such spatial rotation will be obtained. In § 2, corresponding to the Thomas precession [3, 4], introduced in his theory of the kinematics of an electron with an axis on the basis of the Lorentz transformations without rotation, we shall calculate the precession caused by the successive transformations of the new group. In § 3, for the transformations of the new group, we shall give the tensor expression in the 4-dimensional space-time. In § 4, we shall investigate the transformation from the fixed system to the momentary rest system of a particle in arbitrary motion. As a special case we shall show that the successive rest systems of a particle in a periodic motion coincide with the rest systems after a period of the motion to each other.

§ 1

**§ 1. The "Lorentz transformations without rotation" and
the new fundamental group of transformations.**

The "Lorentz transformations without rotation" are defined by the follow-