



EXTENDED LORENTZ TRANSFORMATION AND RELATIVISTIC OBSERVERS

HANS WILHELM ALT

Technische Universität München, Germany
(E-mail: alt@ma.tum.de)

and

GABRIELE WITTERSTEIN

Technische Universität München, Germany
(E-mail: gw@ma.tum.de)

Abstract. In this paper we present the Extended Lorentz transformation, by which we mean a Lorentz transformation $\mathbf{L}(V, \text{Id})$ with a variable relative velocity V completed by a term responsible for the variability. This additional term comes from the well known hyperbolic rotations, which are matrices that leave a hyperboloid invariant. We define Extended Lorentz transformations by using instead of only space rotations all rotations of spacetime. It is shown that a special class of Extended Lorentz transformations fulfills the requirements for a nonlinear relativistic observer transformation, which the classical Lorentz transformation does not. Therefore this theorem breaks the barrier which has hitherto weighed on the theory of Lorentz transformations.

Communicated by Editors; Received April 13, 2025

Mathematics Subject Classification: 83Cxx, 83C10, 35Q75, 83A05.

Physics and Astronomy Classification Scheme: 04.20.Gz, 03.30.+p.

Keywords: Relativity, Lorentz matrix, relativistic Observer, Observer transformation.