

# Lorentz Transformations: a Group Theory approach

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*"The fact that mathematics does such a good job of describing the Universe is a mystery that we don't understand. And a debt that we will probably never be able to repay."*

William Thomson, 1<sup>st</sup> Baron Kelvin

## Abstract

In this work we will focus on Lorentz transformations, that are coordinate transformations between two coordinate frames that move at constant velocity relative to each other. We recall that the term "Lorentz transformations" only refers to transformations between inertial frames, usually in the context of special relativity.

In this work we will derive these transformations focusing on Group Theory properties.

## 1 Introduction

In each reference frame, an observer can use a local coordinate system (most exclusively Cartesian coordinates in this context) to measure lengths, and a clock to measure time intervals. An observer is a real or imaginary entity that can take measurements, say humans, or any other living organism or even robots and computers. An event is something that happens at a point in space at an instant of time, or more formally a point in spacetime. The transformations connect the space and time coordinates of an event as measured by an observer in each frame.

## References