Relativistic field theory

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November 2, 2023

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Preface

This is a live document, and is full of gaps, mistakes, typos etc.

Part I

Spacetime

Chapter 1

The Lorentz metric

1.1 The Lorentz metric

1.1.1 The Lorentz metric

For lorentz:

$(\delta v)^T M \delta v = \delta t^2 - \delta x^2 - \delta y^2 - \delta z^2$

$Action = \int \sqrt{\delta t^2 - \delta x^2 - \delta y^2 - \delta z^2}$

$Action = \int \sqrt{1 - \dot{x}^2 - \dot{y}^2 - \dot{z}^2}\delta t$

$Action = \int \sqrt{1 - v^2}\delta t$

1.1.2 The Lorentz metric with c

For lorentz with c

$(\delta v)^T M \delta v = \delta c^2 t^2 - \delta x^2 - \delta y^2 - \delta z^2$ p $Action = \int \sqrt{\delta c^2 t^2 - \delta x^2 - \delta y^2 - \delta z^2}$

$$Action = \int \sqrt{1 - \frac{\dot{x}^2}{c^2} - \frac{\dot{y}^2}{c^2} - \frac{\dot{z}^2}{c^2}} c\delta t$$

$$Action = \int \sqrt{1 - \frac{v^2}{c^2}} c\delta t$$

Because c is constant, we can simplify to:

$$Action = \int \sqrt{1 - \frac{\dot{x}^2}{c^2} - \frac{\dot{y}^2}{c^2} - \frac{\dot{z}^2}{c^2}} \delta t$$

$$Action = \int \sqrt{1 - \frac{v^2}{c^2}} \delta t$$

1.1.3 Lorentz rotations

1.1.4 Lorentz boosts

1.1.5 The Lorentz group

The Lorentz group consists of the Lorentz rotations and the Lorentz boosts.

1.1.6 The Poincaré group

1.1.7 Group contraction from Lorentz to Euclid

1.1.8 Spacetime interval

1.1.9 Proper time