Philosophy of Special Relativity
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Tutorial 1

“Every particle continues in its state of rest or uniform motion, except insofar as it doesn’t.”
(Eddington)

It is sometimes said that Newton’s First Law is just a definition of inertial frame, and that his
Second Law is just a definition of force. What, if anything, is the empirical content of
Newton’s laws?

Core Reading

R. Torretti, Relativity and Geometry (Pergamon, 1983; Dover, 1996), 1.1-1.5 (pp. 8-19).
On the notion of an inertial frame.

Chapters VI-VII.

you get the older edition).

J. Barbour, Absolute or Relative Motion? Volume 1: The Discovery of Dynamics (Cambridge,
1989), reprinted as The Discovery of Dynamics (Cambridge, 2001). Pages 19-34, and chapter 12. A
popularised version of this account can be found in J. Barbour, The End of Time? (Weidenfeld and
Nicholson, 1999), chapter 6 (pp. 93-108).

Brown, H.R. Physical Relativity: Spacetime Structure from a Dynamical Perspective (OUP 2005),
Sections 2.1 and 2.2.

Ellis, B. The origin and nature of Newton’s laws of motion. In Colodny (ed.), Beyond the edge of
certainty: essays in contemporary science of philosophy, pp.29-68.

Further Reading

a) Geometric approaches

Note: the readings in this section refer to the geometric approach to understanding spacetime
structure and inertia. This is an important and popular approach which ideally you should study.
The problem is that mathematically speaking it is difficult: done properly it involves serious
differential geometry, on a level substantially beyond what you’ve studied so far.

SO: have a look at the article by Earman and Friedman, below. If you can follow the maths, good
for you! – if not, skim or skip the mathematically intense sections and see what sense you can
make of the rest of the paper.
Alternately or additionally: look at the sections from Friedman’s book. He takes the reader rather
more gently through the material, but is less incisive.
You may find the chapter from Earman’s book helpful in getting a feel for the notions involved here.


M. Friedman, *Foundations of Space-Time Theories* (Princeton, 1983), sections II.1 (pp. 32-45), III.1 (pp. 71-86), III.6-II.7 (pp. 108-120).


*b) Other readings*


Tutorial 2

Essay task: Write an essay answering all of the following:

What role do the Relativity Principle and the Light Postulate play in the derivation of the Lorentz transformations?

On the Light Postulate: What is the distinction between saying that the light speed is source-speed independent, that it is isotropic, and that it is invariant; and which of these should we interpret the “constant” in Einstein’s Light Postulate to include?

On the Relativity Principle: It is sometimes suggested that the Newtonian principle of relativity is expressed in our freedom to transform coordinate systems by a Galilean transformation, the special principle of relativity in our freedom to transform by a Lorentz transformation. Do you agree?

Core Reading


Part 1 (sections 1-5).


NB this is in part a textbook; many parts can be skimmed or skipped as of limited philosophical interest.


Further Reading

R. Torretti, Relativity and Geometry (Pergamon, 1983; Dover, 1996), chapter 3 (pp. 48-87).

Alternative discussion of the derivation of the Lorentz transformations, for the more mathematically minded.

M. Friedman, Foundations of Space-Time Theories (Princeton, 1983), sections IV.1, IV.2, IV.5 (pp. 125-141 and 149-158).

An account of the very different, spacetime-geometry-centric, approach to the Lorentz transformations.
Tutorial 3

Simultaneity is variously described as “relative” and “conventional”. What do these claims mean, and which, if either, is true?

Core Reading

An introductory overview.

Another overview.

One of the classic historical loci of the conventionalist view (the other being Grunbaum), and still one of the clearest.

A textbook discussion of the conventionality issue, more advanced than Janis. Surveys the historical development of the discussion, from Kant through Reichenbach, Grunbaum and Winnie. Concludes against conventionalism.

Pro-conventionalist.

Proves that the standard (Einstein) synchrony relation is the only one that is “definable in terms of the causal structure of spacetime and the given inertial worldline”, in a precisely specified sense. Widely, but not universally, taken to be a decisive refutation of the conventionalist view.

Pro-conventionalist.

Further Reading


A geometric perspective. [Covers the same material as some of the above?]

Argues that Malament’s assumption that the simultaneity relation must be time-reversal invariant is unjustified, and hence that his theorem fails to establish the inconsistency of the conventionality thesis and the causal theory of time.


*More mathematical detail on the conventionality argument.*
Tutorial 4

Does the geometry of spacetime (as specified by the Minkowski metric) play an explanatory role in special relativity?

Core Reading


An introduction explaining many of the concepts dear to the spacetime-geometry-realists’ hearts, without appealing to differential geometry.

R. Torretti, Relativity and Geometry (Pergamon, 1983) chapter 4, sections 4.1-4.4 (pp 88-114)
(A geometric account)

G. Nerlich, The Shape of Space (Cambridge, 1976), 10.1-10.9 (pp. 213-251) and possibly also chapter 2 (pp. 29-49), esp. sections 2.7-2.8.


H. R. Brown, Dynamical Relativity (Oxford, 2006), chapter 8 (pp. 128-149).


Further Reading

Further discussion of Bell’s position and its philosophical consequences.

Seminal but rather technical account of the geometric viewpoint

Using geometry to explain in practice