

## 15.1: Introduction to Special Relativity

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Why a chapter on relativity in a book on “classical mechanics”? A first excuse might be that the phrase “classical mechanics” is used by different authors to mean different things. To some, it means “pre-relativity”; to others it means “pre-quantum mechanics”. For the purposes of this chapter, then, I mean the latter, so that special relativity may fairly be included in “classical” mechanics. A second excuse is that, apart from one brief foray into an electromagnetic problem, this chapter deals only with mechanical, kinematic and dynamical problems, and therefore deals with only a rather restricted part of relativity that can be dealt with conveniently in a single chapter of classical mechanics rather than in a separate book. This is in fact a quite substantial restriction, because electromagnetic theory plays a major role in special relativity. It was in fact difficulties with electromagnetic theory that led Einstein to the special theory of relativity. Indeed, Einstein’s theory of relativity was introduced to the world in a paper with the title *Zur Elektrodynamik bewegter Körper* (*On the Electrodynamics of Moving Bodies*), *Annalen der Physik*, **17**, 891 (1905).

The phrase “special” relativity deals with the transformations between reference frames that are moving with respect to each other at constant relative velocities. Reference frames that are accelerating or rotating or moving in any manner other than at constant speed in a straight line are included as part of general relativity and are not considered in this chapter.

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