EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Mathematisch-
Naturwissenschaftliche
Fakultät
Fachbereich Mathematik
AB Geometrische Analysis und
Mathematische Relativitätstheorie

Sommersemester 2023

Special Relativity

Lecturer: Dr. Karim Mosani
Start: Monday, April 17
Time: Monday, 12:15 pm-14:00 pm, C6H10 Seminarraum S10 (C-Bau [Mathe/Physik])
Platform: —

Description

The course is divided into three sections: 1) We will discuss the historical development of the special theory of relativity and its experimental background. To begin with, we will study the incompatibility of the Galilean transformation (the foundation of Newtonian mechanics) and Electrodynamics. Then we will discuss the attempts to locate the Absolute frame and to preserve the idea of Ether. We then state the postulates of Special Relativity. 2) Next, we will learn abstract concepts such as Smooth Manifolds, Metric Tensors, Isometry, Time Orientability, Lorentz Manifold, etc., that will help develop the foundation. 3) Finally, we take the top-bottom approach and use the abstractions studied in the previous section to understand the Newtonion space-time and the Minkowskian spacetime, and some physical consequences such as length contraction, time dilation, and the twin paradox. If time permits, we will discuss the energy momentum and the conservation law.

If desired, the lectures will take place in a hybrid format via zoom and will be recorded for everyone's convenience. Details will be discussed in the first week of classes.

Requirements

Basic Linear Algebra and Calculus.

Literature

R. Resnick, *Introduction to Special Relativity*, Wiley Publication (1968).

B. F. Schutz, *A First Course in General Relativity*, Cambridge University Press (1985).

B. O'Neill, *Semi-Riemannian Geometry With Applications to Relativity*, Academic Press, Math. 103 (1983).

G. L. Naber, *The Geometry of Minkowski Spacetime: An Introduction to the Mathematics of the Special Theory of Relativity*, Springer (2010).

Exam

To be admitted to the exam, you will need to get 50% of all points on the exercise sheets. The exam will be oral. You will be able to choose dates between July and October.