Relativity textbooks

From early undergraduate to graduate courses, Cambridge has a relativity textbook at the right level.

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Gravity from the Ground Up
An Introductory Guide to Gravity and General Relativity
Bernard F. Schutz
Max-Planck-Institut für Gravitationsphysik, Germany

Advance praise:
‘...A marvellous work! What strikes me is its immense range and its solid authority. For me this will be a great resource of encyclopedic knowledge, powerful models, and balanced judgement about our Universe.’

PROFESSOR EDWIN F. TAYLOR
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Key features:
• Highly accessible introduction to astronomy and general relativity
• Imaginative use of high-school mathematics and computer programs to explain deep physics
• Tied to a website providing programs, solutions to exercises and other useful resources: www.gravityfromthegroundup.org

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2.3 Galilean relativity and the other
After Michelson’s electromagnetic apparatus for light propagation was confirmed by Hertz, the east coast on the agenda was to find evidence for the medium in which light propagated. This is where the concept of relativity enters the picture. Galileo first postulated that the laws of physics should be the same for all observers moving at constant relative velocity to one another. In such a system, it is meaningless to say that any one observer is at rest, because a state of absolute rest or motion cannot be detected using the laws of physics. For example, consider some station A sitting on a tennis court and down hill, while sitting on roller skates at a constant velocity V relative to some other station B. (Assume that both skaters in a straight line and don’t speed up or slow down during the motion, so that the acceleration is always zero.) In the coordinate frame attached to station A, the ball is going up and down along what we will call the x axis with zero velocity component along the y axis. In the coordinate frame attached to station B, the ball is going up and down along what we will call the y axis with zero velocity component along the x axis.

3. Elements of spacetime geometry
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5. Spacetime physics of fields
6. Causality and relativity
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10. Looking onward: Appendix A. Where do equations of motion come from?; Appendix B. Basic group theory; Appendix C. Lie groups and Lie algebras; Appendix D. The structure of super Lie algebras; References, Index.
Special Relativity
From Einstein to Strings
Patricia Schwarz
and John H. Schwarz
California Institute of Technology

This book provides a thorough introduction to Einstein’s special theory of relativity, suitable for anyone with a minimum of one year’s university physics with calculus. It is divided into fundamental and advanced topics. The first section starts by recalling the Pythagorean rule and its relation to the geometry of space, then covers every aspect of special relativity, including the history. The second section covers the impact of relativity in quantum theory, with an introduction to relativistic quantum mechanics and quantum field theory. It also goes over the group theory of the Lorentz group, a simple introduction to supersymmetry, and ends with cutting-edge topics such as general relativity, the standard model of elementary particles and its extensions, string theory, and a survey of important unsolved problems. Each chapter comes with a set of exercises. The book is accompanied by a CD-ROM illustrating, through interactive animation, classic problems in relativity involving motion.

Key features:
• Treats advanced topics in relativity such as particle physics, super-symmetry, string theory and causality at a level suitable for undergraduates
• A fully up-to-date treatment of special relativity in any number of spacetime dimensions
• A CD accompanies the book that illustrates problems involving relative motion using interactive animations

Advance Praise
“Patricia and John Schwarz have created an elegant book that uses special relativity to organize a sophisticated discussion of Maxwell theory, differential geometry, symmetry, and field dynamics. This book will reveal to the student the powerful tools that enhance our comprehension of physical theories.”

PROFESSOR BARTON WZIEBACH
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Relativity
An Introduction to Special and General Relativity
Third edition
Hans Stephani
Friedrich-Schiller-Universität Jena, Germany

Thoroughly revised and updated, this textbook provides a pedagogical introduction to relativity. It covers the most important features of both special and general relativity, as well as touching on more difficult topics. The necessary mathematical tools (tensor calculus, Riemannian geometry) are provided, most of the derivations are given in full, and exercises are included where appropriate. The bibliography gives the original papers and directs the reader to useful monographs and review papers.

Key features:
• Thoroughly revised and updated new edition, now including a large section on special relativity
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A Relativist’s Toolkit
The Mathematics of Black-Hole Mechanics
Eric Poisson
University of Guelph, Ontario

This textbook fills a gap in the existing literature on general relativity by providing the advanced student with practical tools for the computation of many physically interesting quantities. The context is provided by the mathematical theory of black holes, one of the most elegant, successful, and relevant applications of general relativity. Among the topics discussed are congruences of timelike and null geodesics, the embedding of spacelike, timelike, and null hypersurfaces in spacetime, and the Lagrangian and Hamiltonian formulations of general relativity. Although the book is self-contained, it is not meant to serve as an introduction to general relativity. Instead, it is meant to help the reader acquire advanced skills and become a competent researcher in relativity and gravitational physics. The primary readership consists of graduate students in gravitational physics. It will also be a useful reference for more seasoned researchers working in this field.

Key features:
• Short, concise and to-the-point
• Focuses on practical methods of computation in general relativity
• Provides advanced skills for those beginning research in this field

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