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Special Relativity in General Frames: From Particles to Astrophysics (Graduate Texts in Physics)

Eric Gourgoulhon

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Special relativity is the basis of many fields in modern physics: particle physics, quantum field theory, high-energy astrophysics, etc. This theory is presented here by adopting a four-dimensional point of view from the start. An outstanding feature of the book is that it doesn't restrict itself to inertial frames but considers accelerated and rotating observers. It is thus possible to treat physical effects such as the Thomas precession or the Sagnac effect in a simple yet precise manner. In the final chapters, more advanced topics like tensorial fields in spacetime, exterior calculus and relativistic hydrodynamics are addressed. In the last, brief chapter the author gives a preview of gravity and shows where it becomes incompatible with Minkowsky spacetime. Well illustrated and enriched by many historical notes, this book also presents many applications of special relativity, ranging from particle physics (accelerators, particle collisions, quark-gluon plasma) to astrophysics (relativistic jets, active galactic nuclei), and including practical applications (Sagnac gyrometers, synchrotron radiation, GPS). In addition, the book provides some mathematical developments, such as the detailed analysis of the Lorentz group and its Lie algebra.
The book is suitable for students in the third year of a physics degree or on a masters course, as well as researchers and any reader interested in relativity.
Thanks to the geometric approach adopted, this book should also be beneficial for the study of general relativity.

"A modern presentation of special relativity must put forward its essential structures, before illustrating them using concrete applications to specific dynamical problems. Such is the challenge (so successfully met!) of the beautiful book by Éric Gourgoulhon." (excerpt from the Foreword by Thibault Damour)

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