



Tensors, Relativity, and Cosmology, Second Edition

By Mirjana Dalarsson MSc - Engineering Physics 1984 Licentiate - Engineering Physics 1989, Nils Dalarsson

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Tensors, Relativity, and Cosmology, Second Edition, combines relativity, astrophysics, and cosmology in a single volume, providing a simplified introduction to each subject that is followed by detailed mathematical derivations.

The book includes a section on general relativity that gives the case for a curved space-time, presents the mathematical background (tensor calculus, Riemannian geometry), discusses the Einstein equation and its solutions (including black holes and Penrose processes), and considers the energy-momentum tensor for various solutions. In addition, a section on relativistic astrophysics discusses stellar contraction and collapse, neutron stars and their equations of state, black holes, and accretion onto collapsed objects, with a final section on cosmology discussing cosmological models, observational tests, and scenarios for the early universe.

This fully revised and updated second edition includes new material on relativistic effects, such as the behavior of clocks and measuring rods in motion, relativistic addition of velocities, and the twin paradox, as well as new material on gravitational waves, amongst other topics.

- Clearly combines relativity, astrophysics, and cosmology in a single volume
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- Presents topics of interest to those researching and studying tensor calculus, the theory of relativity, gravitation, cosmology, quantum cosmology, Robertson-Walker Metrics, curvature tensors, kinematics, black holes, and more
- Fully revised and updated with 80 pages of new material on relativistic effects, such as relativity of simultaneity and relativity of the concept of distance, amongst other topics
- Provides an easy-to-understand approach to this advanced field of mathematics and modern physics by providing highly detailed derivations of all equations

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Editorial Review

From the Back Cover

Relativity, gravitation, and cosmology are all broad areas of modern physics, with an extensive selection of adequate textbooks and monographs for advanced graduate students and professionals working in these fields. Due to some features of the theory of relativity that are very counterintuitive and intriguing for the general public, there are also quite a few books which take a general descriptive approach appropriate for readers with no background in physics. However, intermediate books, intended for senior undergraduate students or new graduate students, are quite rare. It seems to be generally assumed that the new concepts of both physics and mathematics involved in these subjects are too complex to permit a straightforward introduction.

University students trying to grasp these exciting and foundational ideas will encounter hand-waving phrases in the literature allowing that something can be derived from something else by some straightforward although tedious algebra. If a student cannot readily reproduce such straightforward algebra, which is most often the case, the usual reaction is to accept the claim as a fact, but at the price of lost satisfaction in understanding the subject.

This book strives to bridge the gap between textbooks used in a core university program consisting typically of basic calculus and general physics and the advanced graduate level books in tensor calculus, relativity, and cosmology. It was conceived to help students master the background necessary for advanced study without the tedious and time-consuming effort to review the relevant portions of advanced textbooks. More lengthy and algebraic manipulations are outlined in sufficient detail that they can be followed by an interested senior undergraduate student or a beginning graduate student, with minimal risk of getting lost.

This fully revised and updated second edition includes new material on relativistic effects, such as the behavior of clocks and measuring rods in motion, relativistic addition of velocities, and the twin paradox, as well as new material on gravitational waves, such as weak-field solutions, propagation of gravitational waves, generation of gravitational waves, and detection of gravitational waves.

About the Author

Mirjana Dalarsson is affiliated with the Research and Development program at Ericsson Corporation. She holds a Licentiate degree in Engineering Physics and has more than 25 years of research and teaching experience. Former affiliations in the academic and private sector include the Royal Institute of Technology, Belgrade University, Uppsala University, and ABB Corporation.

Nils Dalarsson has been with the Royal Institute of Technology, Department of Theoretical Physics in Stockholm, Sweden, since 1999. His research and teaching experience spans 32 years. Former academic and private sector affiliations include University of Virginia, Uppsala University, FSB Corporation, France Telecom Corporation, Ericsson Corporation, and ABB Corporation. He holds a PhD in Theoretical Physics, an MSc in Engineering Physics, and an MSc in Education.

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