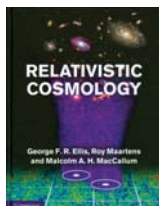


Relativistic Cosmology

George F. R. Ellis, Roy Maartens, and Malcolm A. H. MacCallum
Cambridge U. Press, New York, 2012.
\$130.00 (622 pp.).
ISBN 978-0-521-38115-4

Readers with a basic knowledge of general relativity and a desire to fill in gaps in their knowledge of the geometric and relativistic foundations of cosmology will find *Relativistic Cosmology* to be a valuable and inspiring resource. The book, focusing on the large-scale structure of spacetime and cosmic evolution, is a modern compilation of general relativistic aspects of cosmology. Its three authors, George Ellis, Roy Maartens, and Malcolm MacCallum, are well-known experts in general relativity and cosmology. Ellis is a coauthor with Stephen Hawking of the classic text *The Large Scale Structure of Space-Time* (Cambridge University Press, 1973).

The first of *Relativistic Cosmology's* five parts contains an interesting dis-



cussion of the nature of cosmology and introduces the foundations of the discipline in terms of spacetime geometry and the physics of gravity. The second part presents relativistic cosmology without invoking the cosmological principle that restricts the discussion to isotropic and homogeneous models. The section is extremely useful, as several key relativistic cosmology theorems were published exclusively as school proceedings in the 1960s and 1970s and are thus not easily available. The book presents them in an updated language and notation.

The third section introduces the modern cosmological standard model, the isotropic and homogeneous Friedmann-Lemaître-Robertson-Walker (FLRW) model dominated by a cosmological constant and dark matter. This section also introduces the different formulations of cosmological perturbation theory, but in my opinion, its coverage of cosmological inflation and the quantization of fluctuations of scalar and tensor modes is inadequate and superficial. Those shortchanged ideas give rise to the inflationary power spectrum, a key element of the standard model of cosmology. Without the prediction of an

almost scale-invariant power spectrum, dark energy and many other problems discussed in the book would be viewed differently. Deeper coverage of inflationary cosmology is provided by, for example, Viatcheslav Mukhanov's *Physical Foundations of Cosmology* (Cambridge University Press, 2005).

A big plus of *Relativistic Cosmology* is that it does not stop with the FLRW model but also covers its extensions, including the spherically symmetric Lemaître-Tolman-Bondi models. Although those are usually not considered when scientists describe the universe as we observe it, they are extremely useful for putting tests of the standard model on a more solid basis. *Relativistic Cosmology* combines a treatment of such models with results from modern cosmological observations and goes well beyond other books that focus on the anisotropic or inhomogeneous cosmological solutions of Einstein's field equations.

Section four of the book discusses additional inhomogeneous and anisotropic models. The fifth section, "Broader perspectives," touches on more speculative ideas. The book closes with philosophical remarks on the science of cosmology

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and its limits. It seems to me that the authors could have omitted some of the issues raised in sections four and five, especially because the preface already emphasizes enduring versus ephemeral aspects of the field.

The layout and graphics of the book are quite appealing. The book's Exercises help the reader to reflect on the presented ideas and concepts, and its Problems highlight unsolved issues in modern cosmology. An extensive index and table of contents make it is easy to find a topic of interest. However, citations are not handled consistently. For example, detailed references to original articles are given to support the discussion of covariant linear perturbations, but almost no original works are cited in connection with metric-based perturbation theory. And for those interested in particle-physics aspects of cosmology or in observational details, this is not the book to consult first.

Nonetheless, I strongly recommend *Relativistic Cosmology*. Best suited for graduate students, postdocs, and senior researchers, it offers a lot to explore and to learn about this exciting topic.

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new books

miscellaneous

Springer Handbook of Medical Technology. R. Kramme, K.-P. Hoffmann, R. S. Pozos, eds. Springer, Berlin, 2011. \$199.00 (1500 pp.). ISBN 978-3-540-74657-7

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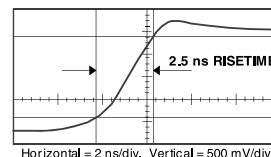
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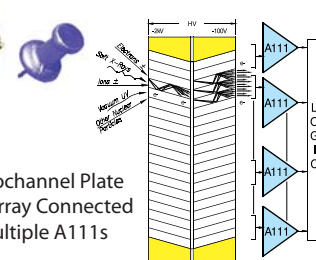
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