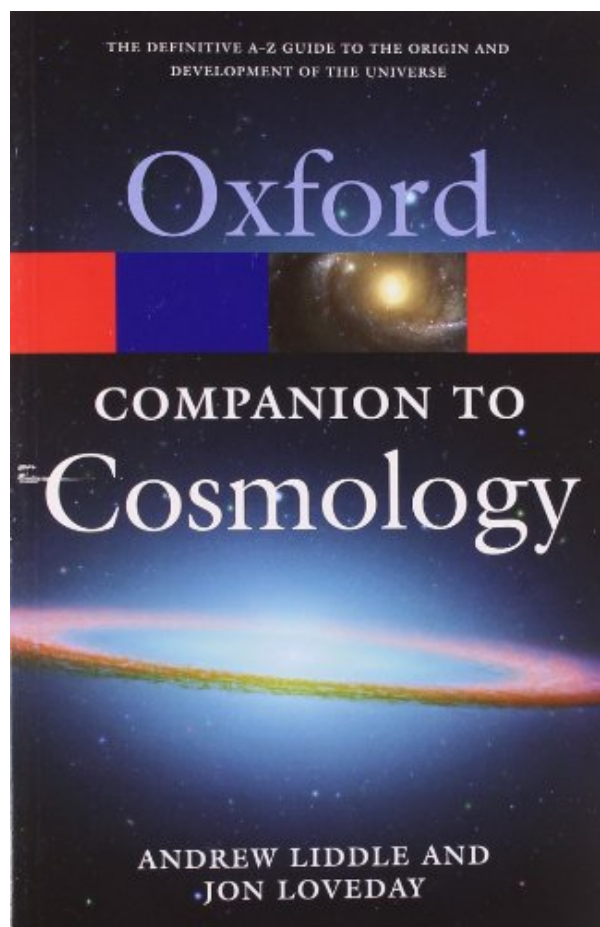
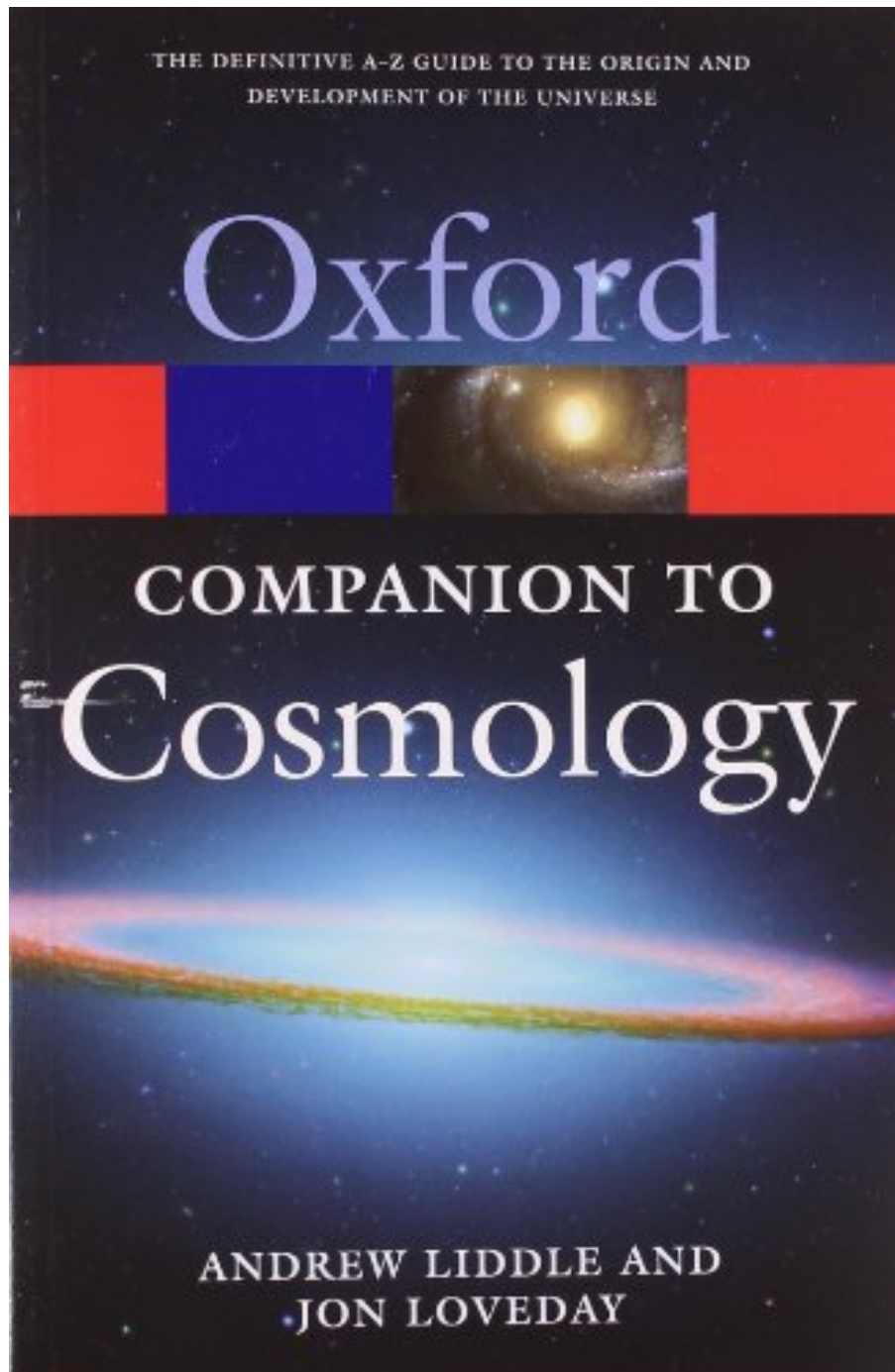


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`authoritative and entertaining' New Scientist

`the range of expertise displayed is very impressive' The Observatory

## About the Author

Andrew Liddle is Professor of Astrophysics at the University of Sussex. He was previously at Imperial College. He is an authority on the theoretical side of astrophysics and cosmology, in particular on the origin and evolution of the structure of the universe.

Jon Loveday is Senior Lecturer in Astronomy at the University of Sussex. He has previously held positions at the University of Chicago, Fermi National Accelerator Laboratory, and the Australian National University.

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Here is a lavishly illustrated, state-of-the-art look at modern cosmology, the only such resource presently available. In more than 350 in-depth entries, Andrew Liddle and Jon Loveday cover the entire scope of this cutting-edge field, from cosmic rays and dark energy to Higgs bosons and neutrinos. Beginning with an introductory essay on Hot Big Bang Cosmology, the Companion illuminates the ideas behind our current understanding of the universe, outlines some of the fundamental physics from which those ideas emerge, and discusses the many strands of observational evidence available to the modern cosmologist. The authors tackle such fascinating topics as anti-matter, the age of the universe, black holes, quasars, and radio galaxies. The book also features biographical profiles of major scientists and informative entries on the tools of exploration such as the Cosmic Background Explorer satellite, the Hubble Space Telescope, and the Keck Observatory. Extensive cross-referencing allows readers to pursue ideas throughout the book, and web links direct the reader to recommended online resources which will be regularly updated via the book's companion website.

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31 of 32 people found the following review helpful.

The biggest Oxford Companion of them all

By Michael Birman

The Oxford Companion series contains several splendid volumes devoted to such things as Wine, the Bible, Classical Literature and the American Musical. This Oxford Companion devoted to Cosmology or the scientific study of the birth, growth and ultimate fate of the universe, is without question the largest and most inclusive one of all. Co-authored by Astrophysicist Andrew Liddle, whose previous books include two superb astrophysics and cosmology textbooks: *An Introduction to Modern Cosmology* and *Cosmological Inflation and Large-Scale Structure*, the purpose of this Oxford Companion to Cosmology is to provide a coherent one-stop resource containing the latest information on the history and structure of the Cosmos.

The past two decades have seen an explosion in knowledge, but as in every cutting-edge scientific field, the more that we discover the more questions we unearth. The stunning discovery in the late 1990s that the expansion of the universe was accelerating has essentially thrown all of our assumptions into a sorting hat, forcing us to explain the mystery of the missing 96% of the matter we think is contained in the universe. It appears to be undetectable with our present instrumentation. So-called Dark Energy, as seen through the lens of String Theory, has literally redefined our definition of the universe. Our universe is now conceived as a multi-dimensional multiverse or Landscape containing  $10^{500}$  universes of utterly different structure and variable physical laws. This makes our uniqueness even less of a pleasant illusion. Some cosmologists are suggesting that a redefinition of gravity, of the speed of light and of Einstein's Relativity are required in order to explain the 'Horizon Problem', the strange flatness and sameness apparent everywhere in the visible universe, even though these far-flung regions have never been in communication with each other. In other words, how can regions that have never been visible to each other "be painted the same color"? Cosmic Inflation, as posited in the 1980s by Alan Guth to explain the 'Horizon Problem', has encountered difficulties that make seeking an alternative explanation a profitable speculative exercise for cosmologists.

Cosmology is in an exciting state of upheaval, and this Companion, with more than 350 relevant entries and 200 photos and diagrams, will make a superb addition to your arsenal of knowledge. What makes it particularly useful is the ability to search for an entry, finding it fairly easily in alphabetical order. Reading a technical article on cosmology often requires that we look up background material. This Companion is superbly well suited for the task. Anyone with an interest in the field will find this volume a welcome addition to their library. Very strongly recommended.

Mike Birman

10 of 10 people found the following review helpful.

This book puts it together very nicely!

By Unhappy Camper

One would not assume that a dictionary approach would work for something as far flung as modern cosmology--But it did so exceptionally well. While avoiding the highly technical, Liddle and Loveday succeed in drawing the landscape in a way that an interested reader cannot miss. And they do it with humor, consistency and clarity. Well done!

8 of 9 people found the following review helpful.

A useful explanatory text, but with significant errors

By madbadgalaxyman

Three stars' due to its unique concept & reasonable execution. A harder marker would give this book 2 stars, due to several significant errors. See the end of this review, which lists many serious inaccuracies.

Firstly, some positives.....This book bravely sets out to explain cosmology in a series of long encyclopedia-style entries, without excessive 'technical' jargon that is unexplained in the other entries, and with only the odd equation at about the college/high-school/beginning-university level. On these terms, it succeeds in giving the persistent amateur astronomer, the science-oriented member of the general public, the educator, or the beginning physics/astrophysics/astronomy or applied-mathematics student, a good general grounding in

the concepts & ideas of cosmology and in the application of physics & math to our observations (measurements) of the universe. It also simplifies and explains much of the complex history, lore, and 'obscure field-specific jargon' of cosmology & astronomy. Furthermore, it provides a "reasonably good or very good" (depending on the area) coverage of current observational data & instruments which are relevant to cosmology, e.g. redshift surveys, large-sky-area imaging Sky Surveys, Space Observatories, very large optical telescopes, astronomical distance measurement techniques, the magnitude system, the Hubble diagram, the Cosmic Microwave Background, etc.

Another strong positive (unusual in a popular-level science book!) is that the authors clearly distinguish between fact and theory and informed speculation. I really like the 'agnostic' tone that the authors adopt when they indicate their much less than 100 percent certainty about a concept (!), especially when they write about currently-not-fully-explainable cosmological concepts like the point-sized 'singularity' from which the entire universe is said to have arisen and the 'dark energy' that is said to influence the rate of cosmic expansion. While accepting the standard Hot Big Bang theory, the authors are not afraid to say that astrophysicists and cosmologists do not fully understand what is going on at the beginning of the universe and that cosmologists do not fully understand the way that the universe and its constituent galaxies have evolved to their current state. The authors also explain some of the wilder speculations in detail (e.g. braneworld cosmology, cosmic strings, 9-dimensional space), and they clearly state when there is no existing evidence for one of these ideas, leaving the reader to draw his/her own conclusions as to whether a specific concept is scientific or theological!

While this book does not explain things fully (which would require a university course in astronomy & cosmology) its main strength is that it provides a broad, extremely detailed, and reasonably-well-written introduction to the concepts and 'mindset' of the cosmologists. Full marks to the authors for taking on this demanding teaching task, but it must be said that they are very far from being masters of scientific prose.....their explanations, while giving the reader 'a fair idea of how something works', quite often do not generate a Very Clear structural/physical understanding of mathematics & physics concepts. (The old masters of scientific prose, such as Hoyle & Gamow & Asimov, proved that it IS possible to clearly explain Detailed math & physics concepts by means of crystalline-clear prose, thereby bridging the divide between physical and verbal thinking.)

Now for some strong negatives:

It is a pity, given the excellent general concept and workmanlike execution of this encyclopedia, that this book contains a lot of information about galaxies and clusters of galaxies that is downright wrong. The authors make a mess of a good number of simple and essential facts about: galaxy clusters, AGNs, galaxy classification & morphology, stellar populations in galaxies, and galaxy kinematics. Because they don't get some of these intuitively understandable 'nuts and bolts' concepts right, it is very difficult to have confidence in the accuracy of their statements about more difficult and abstruse mathematical concepts such as the origin and geometry of the universe! There are many incorrect statements about astronomy in this book. To give a few examples of elementary mistakes made in this book:

- they incorrectly state that the Coma Cluster of Galaxies is the second closest cluster after the Virgo Cluster, conveniently forgetting about the Fornax Cluster, Puppis Cluster, Abell 3627, etc.
- They say that clusters of galaxies are dominated by elliptical galaxies, when in fact many clusters (e.g. the Hercules Cluster) are dominated by spirals. (and I won't even mention their ridiculous Luminous Mass estimate for the Virgo Cluster)
- They incorrectly state that it is the dust component of Earth's atmosphere that scatters and reddens light from the sun and stars.
- They incorrectly define a galaxy group as an association of galaxies, when it is actually a gravitationally-bound structure.

- They incorrectly state that starbursts occur in knots in the outer parts of spiral galaxies, when they actually occur near the center of a galaxy.
- Their discussion of distance modulus includes subtle cosmological corrections such as the K-correction, but the very important 'practical' correction for foreground Galactic extinction is left out.
- The section on Galaxy Rotation Curves absurdly states that all spiral galaxies have outer rotation maxima of about 100 km/s, includes a 'dodgy' diagram, and states that the redshifted side of a rotating Disk Galaxy necessarily has a larger rotation velocity than the blueshifted side.
- The section on Galaxy Classification repeats many 'myths and prejudices' about galaxies that may have been OK in a textbook written in 1960, but which are today known to be incorrect, e.g. that elliptical galaxies do not and cannot contain disks, that all elliptical galaxies are 'old' stellar systems, that the bar component of a disk galaxy is in essence an elongated bulge, that E7 galaxies exist (most of them are actually S0 galaxies), that type Sd galaxies have small bulges (they normally have NO bulge!).
- They misinterpret Dr Kenneth C. Freeman's very important (1970) work on the constant or characteristic Surface Brightness of the disks of spiral galaxies, giving the impression that Freeman's conclusion is wrong, when it is actually correct in the statistical sense.

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