

an admirable job of demonstrating how many of the seminal ideas associated with the Big Bang picture Hoyle actually provided, as well as describing his influence on the generation of researchers who would complete the foundations of the Big Bang theory. Rees's discussions of other astrophysicists, from his former adviser, Dennis Sciama, to his former classmate, Stephen Hawking, are equally enlightening.

The first three-fifths of the book gives a concise overview of the observational basis of the standard cosmological menagerie, from dark matter to galaxy formation. Here we are on firm ground observationally, and Rees is on territory in which he is a master. From this point on, he slowly begins to venture back in time and out in space until he manages to reach the idea of multiverses themselves, in the last quarter of the book. Not only are many of the ideas more tenuous from this point on, but Rees must depart from subjects of his own expertise. Here some errors filter in—both minor (the large Irvine–Michigan–Brookhaven proton decay detector was in a salt mine, not a zinc mine) and, less minor, (Rees's comparison of the conceptual status of quarks to superstrings and other universes is, in my opinion, off the mark, and his history of the electroweak theory omits at least one notable physicist). Nevertheless, Rees shows great breadth of knowledge and retains throughout his ability to focus on and describe sensible ideas. Moreover, his level-headedness, even when discussing ideas that verge on metaphysics, is gratifying. His discussion of that much-maligned and slippery notion called the anthropic principle is marvelous. One leaves the book feeling that, if Rees is attracted to the idea that multiverses might justify an anthropic explanation of our origins, it is probably an idea worth serious consideration.

The writing style is fluid and easy to read, although some tighter editing in places might have helped. (There are a few repetitions of ideas, for example, including the nature of a flat universe, the phenomenon of black hole radiance and the predictions of Big Bang nucleosynthesis.) There are extensive endnotes, which add to the detail of the text (although I always find it disruptive to have to flip to the back of a book while trying to follow the line of argument contained in the main text). All in all, this is a very valuable piece of popular writing, well worth a read. Those who do stand to learn something new. I certainly did.

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Highly Evolved Close Binary Stars: Catalog

▶ Anatol M. Cherepashchuk,
Natalia A. Katysheva,
Tatjana S. Khruzina
and Sergey Yu. Shugarov
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Highly Evolved Close Binary Stars: Finding Charts

▶ Anatol M. Cherepashchuk,
Natalia A. Katysheva,
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Close binary stars are a cornerstone of modern astrophysics. Early in this century, Joel Stebbins, Fay Brown and others used the optical light variations and orbital motion of eclipsing pairs of stars to derive precise stellar masses and radii. Data for many such close pairs yielded the first mass–radius and mass–luminosity relations for normal stars like the Sun. These results laid the foundation for understanding of our current stellar evolution and for much of early astrophysics.

More recently, a variety of ground-based and space-based surveys have identified extreme binary systems that emit much of their radiation at ultraviolet and x-ray wavelengths. Instead of two normal, main sequence stars, these binaries often contain a compact star, such as a white dwarf, neutron star or a black hole, surrounded by a disk of material stripped from the companion star. The high-energy processes in these binaries, both inside and outside of our Galaxy, are the focus of much of modern astrophysics.

In *Highly Evolved Close Binary Stars*, Anatol Cherepashchuk, Natalia Katysheva, Tatjana Khruzina and Sergey Shugarov have produced a two-part, comprehensive summary of interesting “high-energy” binary systems. Together, although bound separately, they are Volume I of a promised series of monographs on *Advances in Astronomy and Astrophysics*. (Volume II, in preparation, will be called *The Basic Physics of Accretion Disks*.) The first part, *Catalog*, begins with an overview of the time evolution of massive close

binary systems, on which the authors are acknowledged experts. Succeeding chapters briefly describe the basic observational characteristics of many specific types of binaries, including a list of individual binary systems in each category. Many of these digests review physical models for particular classes of binaries and point out major unanswered questions. The second part, *Finding Charts*, consists of 335 small maps of the sky, each used to locate a specific object relative to nearby stars and galaxies. Each of these books includes a comprehensive bibliography but neither contains an index.

Although sometimes incomplete, the *Catalog* is a useful and often engaging introduction and reference source for evolved close binary systems. The opening chapter provides a good description of the evolution of massive binary stars, with a fine historical overview and an exhaustive reference list. The summaries of various massive binaries in chapter 2 are interesting and reasonably complete. In chapters 3 and 4, the lack of a concise review of evolutionary processes for low-mass binaries that parallels the expert treatment of high-mass binaries in chapter 1 is an important omission. For both low- and high-mass binaries, the list of specific systems omits many known systems. Fortunately, the authors point out more complete catalogs in the main introduction and throughout the text.

Finding Charts is also valuable. Each page includes two charts for each binary: a low-resolution map to illustrate the general field of the binary and a high-resolution map suitable for planning observations. Each chart is clear and well reproduced. Many also show positions and list the optical fluxes of nearby stars of constant brightness. These data are especially helpful for scientists interested in following the often erratic brightness variations of most close binaries. A uniform scale for all of the charts would have made *Finding Charts* even more helpful.

Highly Evolved Close Binary Stars is clearly written and well organized. Both parts will provide a useful introduction for graduate students and a valuable reference for more experienced researchers. I recommend *Finding Charts* to amateur astronomers interested in studying individual binaries with sensitive charge coupled devices. The paperback versions are especially affordable; the books would be an effective addition to the library of any professional observatory.

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