

Book Review

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The Life and Death of Stars

Kenneth R. Lang, 2013, 332 pages, quotation references, author index, subject index, ISBN 978-1-107-01638-5. Price \$39.99, hardcover. Published by Cambridge University Press.

The Life and Death of Stars by Kenneth R. Lang describes in great detail the formation, life stages, and final states of the stars. Its approach is even more thorough than a standard introductory textbook, but it avoids using any equations, often describing in many sentences what the equation would show in a single line. While entirely descriptive, it is not a breathless, gushing, glossy portrayal of what we have learned about the stars.

The first few chapters concentrate on the fundamental physics of light, gravity, motion, atomic structure, and spectral lines, and the basic nuclear reactions that create the heat and light of the stars. After this foundation, Lang turns his attention to the Sun, starting in its core with the production of its energy, then moving out through the interior and photosphere to the outer atmosphere, and then to the realm of space plasma that permeates the solar system and produces various forms of space weather. There are numerous figures illustrating the concepts being described, as well as Focus boxes where more detailed descriptions are provided. The coverage is up-to-date, describing results from solar seismology as well as presenting continuing questions such as the faint-young-Sun paradox.

After this extensive treatment of the Sun, Lang turns to the other stars, first concentrating on the range of basic properties of distance, diameter, luminosity, colors, temperatures, and masses, and ending with a description of stellar motions and star clusters. The ranges of these quantities are collected in numerous tables as well as being displayed in fundamental diagrams such as the mass-luminosity relation and the Hertzsprung-Russell diagram.

With the basics of stellar structure and evolution covered, the focus shifts to the interstellar material from which the stars formed, first just the physical properties of the gas and dust, and then on to the process of stellar formation. As part of this description, Lang also covers the detections of planets that form with these stars.

After this Lang switches to the various ways that stars come to the end of their lives, depending on stellar mass and the influence of stellar companions. Again, there are numerous tables and figures to amplify the descriptions in the text.

The next to last chapter broadens the focus from stars and star clusters to the Milky Way that contains all the stars we see. In some ways this was a natural

progression because the stars form, live, and die in the Milky Way, but in other ways this chapter seemed inappropriate for the book's primary focus on stars. The massive black hole at the galactic center, the different kinds of galaxy clusters, and the expanding Universe seemed out of place.

The final chapter, titled "Birth, Life, and Death of the Universe" continued the trend of the previous chapter to reach the ultimate distance from the theme of stars. In fact, in some places it almost seemed to become un-scientific, such as when it stated that "conservation of energy or momentum, which are valid within a restricted range of conditions" or "equations sometimes are disconnected from the observable world."

In addition to the diversion in the final chapter from the primary theme of the book, I also found a lack of uniformity in some of the numerical values, a tendency to repeat things in different chapters that seemed to fragment the flow, and I would have preferred to have the color images incorporated into the flow of the text instead of having black and white versions there and the color versions collected in the middle of the book. Overall, however, *The Life and Death of Stars* was a rewarding and stimulating book that gives an in-depth description of our understanding of all aspects of stars. I particularly liked the many historical foundations that were provided, some of which were new to me and that I plan to incorporate into my courses, as well as the many literary quotations that show the central place of astronomy, and stars in particular, in the life of the human mind.

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