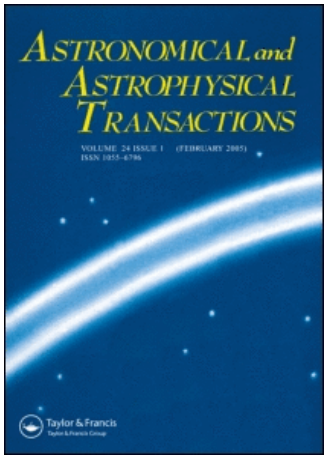

Astronomical & Astrophysical Transactions
The Journal of the Eurasian Astronomical Society
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713453505

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Online Publication Date: 01 June 2001
To cite this Article: (2001) 'A review of "An introduction to the theory of stellar structure and evolution"', Astronomical & Astrophysical Transactions, 20:1, 191 - 192
To link to this article: DOI: 10.1080/10556790108208212
URL: http://dx.doi.org/10.1080/10556790108208212

Astronomical and Astrophysical Transactions, 2001, Vol. 20, pp. 191–192
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Book Review

AN INTRODUCTION TO THE THEORY OF STELLAR STRUCTURE AND EVOLUTION

by Dina Prialnik

Cambridge University Press, 2000, 261 pp.

(Received January 1, 2001)

The theory of stellar structure and evolution is the most important theoretical foundation of the today's astrophysics of stars. To understand any event in the realm of stars, an astrophysicist should consider it from the point of view of the evolutionary status of objects involved. It is also impossible to understand population of star clusters or of galaxies without evolutionary approach. Studying variable stars, we again turn to the theory of stellar evolution, together with the theory of stellar pulsation. For 25 years, I am lecturing on variable stars at the Department of Astronomy, Moscow University. My experience shows that, unfortunately, a considerable part of my audience lack sufficient background in the field of the stellar evolution theory. One of the reasons for this unpleasant fact is probably absence of an introductory book good enough. I do wish my students to read Dina Prialnik's interesting and very instructing presentation.

It is quite evident that the author enjoys fascination of the modern astrophysical theory, of its close ties with quite diverse branches of physics. The theory of stellar structure and evolution gives very good possibilities to demonstrate these close ties, to remind readers of many important concepts of physics, and to show how these concepts govern internal structure of stars, their origin and ultimate fate.

Of the ten chapters of the book, the first one describes the observational background and introduces the basic assumptions. Then, four chapters deal with the physics of principal processes. The sixth chapter discusses stability and instability of stars. The four last chapters describe the general pattern of stellar evolution, first schematically, and then in detail, final products of stellar evolution, and the general scheme for the stellar life cycle.

In most cases, the author is able to present physics of evolutionary processes quite rigorously, or with absolutely justified simplifications. She specially turns the reader's attention to the fact that simplifications are not just an inevitable evil but

that they are important for revealing really significant connections and making the solution possible. Only in Chapter 8 (*The evolution of stars – a detailed picture*), the author has to warn us that the chapter is necessarily descriptive rather than analytical. The book gives much important information on such modern developments as neutrino astronomy (solar neutrinos as well as neutrinos from SN 1987A), studies of neutron stars, black holes, brown dwarfs, etc.

I'd like to mention specially that the book contains a number of very interesting quotations from outstanding astrophysicists of the 20th century, among them Sir Arthur Eddington, Martin Schwarzschild, Bengt Strömgren and others. These quotations illustrate great insight of these great people and help to explain important concepts to the reader.

The things I don't like in the book most probably reflect different ideas on such books that observers and theorists have. Also, Russia is different from the western countries in the respect that, in Russia, we expect students starting to learn stellar evolution to have more of preliminary knowledge in astronomy. So it seems somewhat artificial for me to completely avoid, in such a book, magnitudes and spectral types. Well, you can explain evolution without them, but maybe your students will begin asking questions like why, in the H–R diagram, the temperature grows to the left. In the observational approach to stellar evolution, star clusters are important tools. Dina Prialnik also uses clusters, but her choice of their H–R diagrams (p. 12) is not good. The diagrams are old, with large ('photographic') scatter of data points. Moreover, the author has selected M3 as the example of a globular cluster, but she does not even mention blue stragglers; I'd recommend simply to change the cluster. And I am not sure that the readers will have a clear understanding of the sequences like the horizontal branch after reading the book. Evolution of massive stars is definitely more spectacular, but we should remember that low-mass stars are dominant in the stellar population of galaxies, and their evolution is best demonstrated with the example of globular cluster stars. Then, from the book, the reader will learn something about variable stars, like Cepheids or RR Lyraes, but will not hear anything about the existence of the theory of stellar pulsations. Binary stars are very frequent in the stellar world, and evolution of close binaries has many peculiarities. I understand the author was, for clear reasons, not able to include all this physics into the introductory book, but I would nevertheless prefer to find more (at least qualitative!) information on this subject presented: it is connected with such important phenomena as, for example, X-ray sources, also having much to do with stellar evolution. As already stated, the book's historical passages are very good; however, speaking about the prevalence of hydrogen in stars (pp. 85–86), it is just unfair not to mention Cecilia Payne-Gaposchkin.

Once again: I'll certainly recommend our students to read and study Dina Prialnik's book. Moreover, I am sure I'll have many occasions to look up this book for information myself, so I'd be happy to have it on my bookshelf.

N. SAMUS