Book Reviews

Title: ***Astronomy – A Self-Teaching Guide, 7th Edition***
Author: Dinah L. Moché
Publisher: John Wiley & Sons
Date published: 2009
Status: In print
Availability: New paperback available from booksellers for US$19.95 and from Amazon.com for $13.57. Also available on the used book market (for example, www.abebooks.com) for as low as US$1

Title: ***A Question and Answer Guide to Astronomy***
Authors: Pierre-Yves Bely, Carol Christian, and Jean-René Roy
Publisher: Cambridge University Press
Date published: 2010
Status: In print
Availability: New paperback available from publisher for US$29 and from new and used booksellers and Amazon.com for US$15 to US$20.

Title: ***Starlight – An Introduction to Stellar Physics for Amateurs***
Other: Patrick Moore's Practical Astronomy Series
Author: Keith Robinson
Publisher: Springer
Date published: 2009
Status: In print
Availability: New paperback available from new and used booksellers and Amazon.com for US$20.

The interest of serious amateur radio astronomers goes far beyond electronics. Most also are interested in how stars and other celestial objects form and evolve, the makeup of the solar system and how it works, transient objects such as meteors and comets, and the possibilities of life elsewhere, among many other things.

The following are reviews of three books that cover these topics in a non-technical way. They all emphasize optical astronomy but many topics also apply to radio astronomy. While each book is distinct there is some inevitable overlap. I found all three very useful in my amateur radio astronomy activities. They provided a good refresher of my limited previous knowledge, filled many gaps, and brought me up to date. I am mainly interested in radio astronomy and not optical, but I feel I gained a much broader knowledge of the universe by reading them.

The authors of these books all are astrophysicists. Moché is an accomplished author of "astronomy books and programs for all ages" and who runs a website called Spacelady.com. Bely, Christian and Roy are heavily involved in the design and use of optical telescopes, and Roy "owns two of the biggest telescopes in the world." Robinson is a full-time writer and educator. While it obviously is very important that authors know their subject, what is written is far more important than who it was written by.

The first two books do not need to be read cover-to-cover but may be used as handy references. The internet has become a great resource for answering quick astronomy questions but it seems like many queries yield thousands of responses. Most do not provide a useful answer and some are flat wrong. Why not just grab one of these books off the shelf and look it up?

The first book, ***Astronomy – A Self-Teaching Guide***, has a conventional layout but with some added features that make it useful for self-study and learning. For one, icons are printed next to topics to remind the reader of additional learning resources and information in the book:

- Star and moon maps in the back of the book with a star or moon icons placed in chapter text for referral to them
- An icon indicating simple activities that the reader can do to demonstrate a basic idea (for example, in the section on magnetism, the text describes putting a magnet under a piece of paper and sprinkling iron filings on it – an experiment we all performed in school but still fun to do).
- An icon indicating an internet link to images and updated reports

For another, this book provides short quiz questions interspersed throughout the text and a 2-page self-test at the end of each of the 12 chapters. For example, one quiz question in Chapter 8 is: "*How far would a planet be from the Sun if its orbital period were observed to be 8 years?*" The answer is found by applying Kepler's 3rd law of planetary motion, where the square of the planet's orbital period in years equals the cube of its distance from the Sun in astronomical units. (The answer is 4 astronomical units).

The reader is not left wondering about right or wrong answers to quizzes and tests – the author has provided the correct answers on following pages. Space is provided for writing in the answers so, if you buy a used copy of this book, it already may have answers or other marks. Each chapter begins with a list of learning objectives, making it easy to find topics of interest or to skip others while flipping through the pages. For example, one objective stated at the beginning of chapter 8, Exploring the Solar System, is: "*Explain the apparent motions of the planets, including retrograde motion.*" The text explains that retrograde motion is the apparent reversal of a planet's motion as observed on Earth before it resumes direct forward motion. This phenomenon is easily observed with Mars. Although not listed in the book, an animation can be viewed at: http://www.lasalle.edu/~smithsc/Astronomy/retrograd.html

This book will be attractive to readers who fear math – the author says in a message *To The Reader* in the front papers: "*Mathematics is not required.*" Actually, if you are going to apply Kepler's 3rd law in the above quiz question, you will do some pretty basic number manipulation, preferably with a calculator. Approximately five pages of the book's 365 total pages are dedicated to useful resources and websites for periodicals, databases, career information, almanacs, observing guides and star atlases. Another five pages have six appendices including a list of constellations, physical and astronomical constants, measurements and symbols, periodic table of elements, the nearest stars and Messier objects. The reader will refer to these appendices while working on the tests. The index is a little more than 10 pages and **bold** entries indicate the page where the term is defined, making it easy to find. There is a lot of useful information in this book, and the author has made it is easy to learn.

Astronomy – A Self-Teaching Guide starts out with a brief introduction of the *Cosmic View* – the solar system and where it fits in the Milky Way galaxy and where the Milky Way fits in the universe. Chapter 1, *Understanding the Starry Sky*, covers the preliminary details such as locating sky objects by their right ascension and declination, definition of a sidereal day and solar day and why they are different and why we care about the difference, star brightness, apparent daily and annual motion of stars and Sun, and many other basic astronomical topics. Each topic has about one-third to one-half page of explanatory text, usually an accompanying illustration or table, and a quiz question. I found the discussions very easy to read and follow.

Chapter 2, *Light and Telescopes*, has something for both optical and radio astronomers. After a review of wavelength, frequency and the electromagnetic spectrum, the author provides a short discussion of blackbody radiation. There are particularly good discussions and illustrations of the differences between refracting and reflecting telescopes and useful discussions of magnification and resolving power. Unfortunately, the *something* for radio astronomers in this chapter is pretty sparse, amounting to slightly over two pages that are too basic to be very useful.

Chapters 3 – 7 cover in order The Stars, The Sun, Stellar Evolution, Galaxies and The Universe. Many astronomy books start out in the solar system with a discussion of the Earth, the Moon, the planets and the Sun, and then move toward outer space from there. In ***Astronomy – A Self-Teaching Guide***, the solar system is covered in 28 pages in chapter 8, Exploring the Solar System, after we learn about the very big picture of the universe. This book makes good use of illustrations, and the captions are appropriate (right, figure 3.13). In chapter 9, Planets, the objectives include comparing and contrasting the terrestrial planets and the gaseous planets. This is a fairly standard way of learning about the planets, but I think this book takes an additional step by breaking them down by the way we look at them; for example, sections for Mars are Mars: Observing, Mars: The Surface, Mars: The Planet, and Moons of Mars. The descriptions of each planet are concise, and the important facts are well explained.

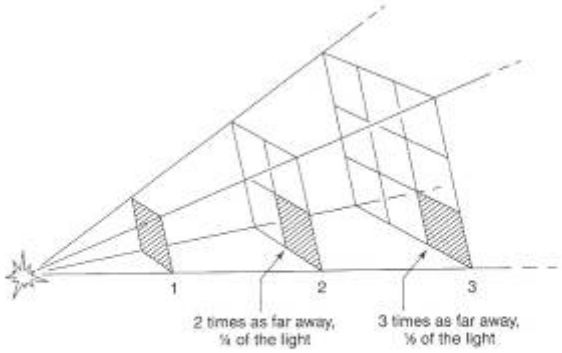
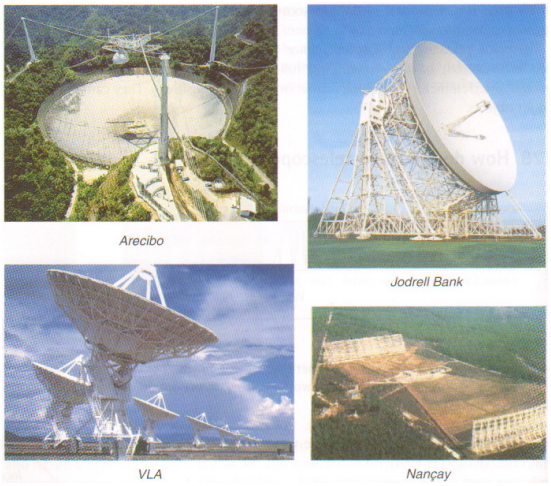


Figure 3.13. Inverse square law. The same amount of starlight that shines on a square at 1 spreads out to illuminate four equal squares at 2 and nine equal squares at 3. Thus, if two stars have exactly the same luminosity but one is twice as far away from you as the other, the distant one will look only ½² = ¼ as bright as the closer one, because you get one fourth the light in your eyes.

Comets always have been interesting to people – maybe because of their fleeting nature and mysterious appearance with tails and a nucleus and their recurrence – as short as three years and as long as a million years. And what about that Oort Cloud, the spherical shell of icy objects about a light-year from the Sun, which apparently supplies the comets we see? The Oort Cloud is discussed in chapter 11, Comets, Meteors and Meteorites, and was named after Dutch astronomer Jan Oort, who first modeled it in the 1950s. You will not find *Nibiru* or *Planet X* in this book.

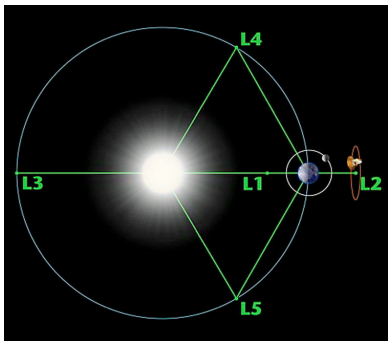
Chapter 12, Life on Other Worlds, is necessarily philosophical and speculative. There is the usual attempt to estimate the odds of other-world life. The answer to a quiz question about

estimating the probability of other-world life – "*Why do you think the average lifetime of an intelligent civilization is the most uncertain number of all?*" is a question itself: "*Will* (a civilization) *last long enough for a conversation, or will it self-destruct with nuclear weapons, pollution or overpopulation?*" Ouch! That reminds me of why no intelligent civilization has ever contacted us: They observed Earth and found no intelligent life to contact (they apparently received our television transmissions).



My next book selection is ***A Question and Answer Guide to Astronomy***. As the title says, this book is a series of questions and answers. These have been organized in topical chapters, such as Stars, The Solar System, Earth, Moon, and The Universe. There are chapters on the History of Astronomy, Telescopes and Amateur Astronomy, among others. The authors devote a couple pages, out of 280 total pages, to radio astronomy in the Telescopes chapter. Here they spend one page describing large dish antennas (left, from page 242) but do not mention the other important components such as the receiver and signal processing (Question 228). They do mention some interferometers (Very Long Baseline Array, VLBA, and European Very Long Baseline Interferometer Network, EVN), which are used to improve the resolution of observations. In the question following those discussions (Q229), the authors say "*Observations at radio wavelengths are highly informative . . . .*" but they do not say why they are informative and they say nothing of how an aspiring amateur radio astronomer can get involved in those 'highly informative' observations. However, in the chapter Amateur Astronomy, Grote Reber's important contributions to radio astronomy are acknowledged. The fact that he built his radio telescope in his back yard with his own money and studied radio astronomy on his own time rightly made him an amateur but for almost a decade he was the only radio astronomer on the whole planet. Karl Jansky, the first-ever radio astronomer and the person who inspired Reber, is mentioned in one sentence.

All-in-all, this book asks and answers 250 good questions, from Why do stars shine? (Q1) to How can you find an amateur astronomy club? (Q250). In between, we have What are Lagrangian points? (Q63), What causes the Earth's magnetic field? (Q89), What explains the dim light suffusing the dark portion of a crescent Moon (Q113), Why do stars twinkle (Q125), Does the Universe have a center? (Q132), What is Life? (Q169), Can we learn anything from the astronomical phenomena reported in the Bible? (Q190) and Which orbits are used for space telescopes? (Q224).



Q63 is interesting because we have had spacecraft orbiting at some Langrangian points (right, from NASA). We are told there are five points (L1 to L5) in the Earth's orbit around the Sun where a body with low mass (spacecraft or asteroid) would move in a circular orbit around a

large mass (Sun) synchronized with a body of intermediate mass (Earth) because, there, the combined gravitational attraction of the two large bodies is exactly balanced by centrifugal force. The SOHO (Solar and Heliospheric Observatory) spacecraft is located at L1 and WMAP (Wilkinson Microwave Anisotropy Probe) spacecraft is at L2. L3 is behind the Sun and it would be difficult to communicate with a spacecraft there (besides, that is where *Planet-X* is located). I could not find anything on NASA's website that indicated spacecraft at L4 and L5, which are about 93 million miles ahead of and behind Earth.

My final book selection is ***Starlight – An Introduction to Stellar Physics for Amateurs***. Unlike the previous two books, this one is focused on stars. This book does not use the usual language of physics – mathematics – to describe the very complex life of stars. Instead, it uses a little algebra and trigonometry at a level readers learned in high school. The author says at the beginning "*There will surely also be many who would say that for the work they do, they simply have no need for . . . theoretical background – but wouldn't it be nice to have it anyway, especially if it could be made more accessible and didn't require a higher education level background in physics and mathematics? This book is written for those amateur astronomers who would be inclined to answer 'yes' to this question and who do not have said background in math and physics.*"

The coverage of this book is the basic operation of "typical" stars and how we measure them in the visible spectrum; there is little discussion of more complicated stellar implementations such as quasars, pulsars and magnetars. Perhaps it is this limitation in scope that would make this a good beginner's book. It is easy to read and understand, but it does have some annoying traits and distractions.

The length of this book is 277 pages including a functional 4-1/2 page index and three short appendices (Greek Alphabet, Astronomical and Physical Units and Constants and The Doppler Effect). Each chapter is about 15-25 pages long, but they are not numbered:

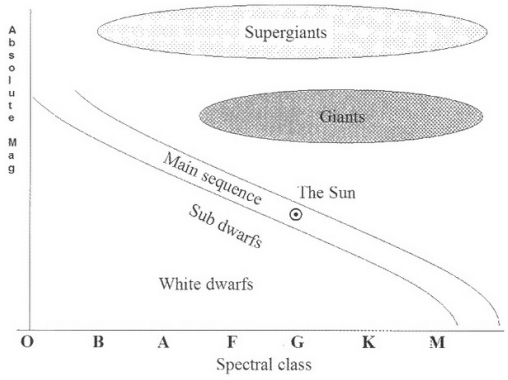
- A River of Starlight
- Starlight by the Numbers
- From Light to Starlight
- Space – The Great Radiation Field
- A Multitude of Magnitudes for the Colors of Starlight
- The Photons Must Get Through – Radiative Transfer
- First Look Inside a Star – The Atmosphere
- Deep Inside a Star
- In the Space Between Stars
- A Star Story – 10 Billion Years in the Making

Each chapter is broken into unnumbered sections of a few pages. Because the chapters and sections are not numbered, there is no easy way to reference the material for discussion, future use or organization. On the other hand, the short sections make them easy to go through without getting bogged down in long and drawn-out discussions where you lose track of what is going on. The author provides a marginally useful one-page list of "Key Points" at the end of each chapter.

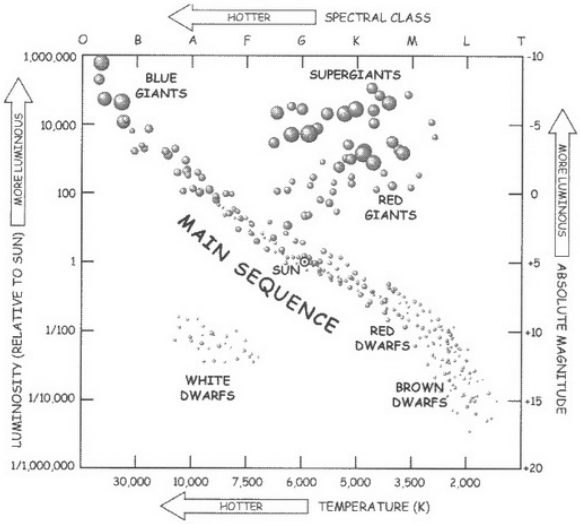
There are only a few tables in this book. It has simple black-and-white and gray-scale illustrations. I felt there could have been more tables and illustrations and the illustrations could have been better quality. It appears that some illustrations were originally made in color and then printed in gray-scale. As a result they are dark with little contrast and detail is hard to see. Readers will not find heavily processed and enhanced images of stars in this book (which makes this book quite different from many books about stars). The question I had to ask was "Does the layout and format of this book inhibit its usefulness?" I believe that, from the view-point of reading through the book once, no, but as a future reference, yes.

The author says "*Stellar physics is basically all about learning to interpret and understand the information that is contained in starlight.*" If the author means visible light, then he missed the point by a light-year because stellar physics involves much more than just visible light. If he takes the word "light" to mean electromagnetic radiation in general, then, indeed, studying electromagnetic radiation is the only way we will ever be able to understand stars. However, even though he does discuss the general scope of electromagnetic radiation in the first chapter, nowhere does he acknowledge that our understanding of stars is far from complete if we only study their visible light.

About one-third of the way through there is discussion and some brief applications of the Hertzsprung-Russell (H-R) diagram used to classify stars (right, figure 5 from the chapter A Multitude of Magnitudes for the Colors of Starlight). The H-R diagram plots each star on a scatter graph according to its absolute magnitude or brightness and its temperature and color from the hottest to coolest. It turns out that around 90% of the stars we can see fall on a lazy S-shaped line called the Main Sequence. Stars are assigned a spectral class based on their temperature, where the classes are O, B, A, F, G, K, and M. The letters do not stand for anything in particular; they simply are a sequence of letters that are left over from early work on star classification. Like the star magnitude scale, first-time users will be left scratching their heads as to why something so important has to be illustrated in such a hard way (answer: tradition). Because of the problem remembering the letter sequence, readers are told that astronomers instead remember the phrase – Oh, Be A Fine Girl (Guy), Kiss Me.

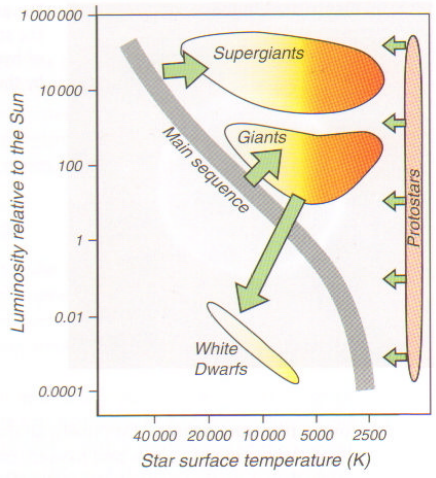


The H-R diagram has many forms, and the author describes some of them. However, we are left with this confusing "Key Point" at the end of the chapter: "*A plot of luminosity or absolute magnitude against stellar spectral class results in the famous Hertzsprung-Russell diagram, which itself showed that stars also need to be*



classified according to their luminosity". Add this to the author's annoying use of 'further' in place of 'farther' throughout the book and readers will find themselves wishing there had been a better proof-reader.

It is interesting to compare the H-R diagrams from each of the three books being reviewed here. I think ***Astronomy – A Self-Teaching Guide*** has the best and easiest to understand – it dispenses with the confusing letter classifications and shows temperature on the horizontal scale rather than an unintuitive series of letters (above-right, figure 3.16). The H-R diagram in ***A Question and Answer Guide to Astronomy*** is similar and even simpler (right, from page 17).



In conclusion, I have reviewed three useful introductory books. Readers of this review may ask, "Well, which one is the best?" I liked the first two equally but if I had to choose only one I would take ***Astronomy – A Self-Teaching Guide***. I think readers wanting to focus only on stars will find the last one the most useful, but I cannot help but feel there are better books about stars than this one. One advantage to all three books is their cost will not break the bank if it does not meet your needs.

Whitham Reeve was born in Anchorage, Alaska and has lived there his entire life. He became interested in electronics in 1958 and worked in the airline industry in the 1960s and 1970s as an avionics technician, engineer and manager responsible for the design, installation and maintenance of electronic equipment and systems in large airplanes. For the next 38 years he worked as an engineer in the telecommunications and electric utility industries with the last 33 years as owner and operator of Reeve Engineers, an Anchorage-based consulting engineering firm. Mr. Reeve is a registered professional electrical engineer with BSEE and MEE degrees. He has written a number of books for practicing engineers and enjoys writing about technical subjects. Since 2008 he has been building a radio science observatory for studying electromagnetic phenomena associated with the Sun, Earth and other planets.