REVIEW

Worlds Unnumbered
The Search for Extrasolar Planets
by Donald Goldsmith
Black and white and color photographs and illustrations. Hardcover. $28.50.

The past few years have been truly exceptional for space science. Observations using the Hubble Space Telescope have permitted a glimpse of the universe at a time roughly one billion years after its creation, a time when many astronomers expected to see galaxies in the earliest phases of their lives. Instead, they observed galaxies similar to their modern-day counterparts, along with a hint that galaxies may form by assembly of subgalaxy-sized clusters of stars. Detailed studies of a meteorite that appears to have come from Mars gave rise to an interpretation that the meteorite contained signs of past life on the Red Planet. And astronomers who have long sought evidence of other planetary systems were finally able to detect substellar mass companions to a handful of nearby stars. The enthusiasm that greeted these detections is understandable; however, more work is needed before their interpretation as planets, rather than brown dwarfs or a new class of object, can be validated. The need for interpretive caution notwithstanding, Donald Goldsmith has written a 200-plus-page book that summarizes some, but not all, of the new observations.

Goldsmith's book is intended for a nonprofessional audience. There are no equations and only a few technically oriented illustrations appear in the book. Because such a book does not rely upon the usual trappings that scientists use to communicate with each other about the technical aspects of their work, it must use not only vivid, but useful and correct analogies to convey technical concepts. A book of this nature should be factually correct, and where there is uncertainty, it should convey that unashamedly. Books such as this are often the connection between the professionals and the public and as such they carry a responsibility to portray accurately what we know. They should also portray those things that we do not know in just that light, without falling prey to the temptation to pass on to the public unproven interpretations of experiments or observations. The public should be allowed to share in the process of debate that scientists engage in as they do their work. This book fails on several counts; the most critical failing is discussed at the end of this review.

While one might assume from the title that the book deals solely with the search for other planetary systems (or for extrasolar planets), only about half the book covers that aspect of the story. Much of the remainder deals with questions of life elsewhere in the solar system as well as the possibility of life outside the solar system. This aspect of the book offers a brief, Reader's Digest tour of the many profound and complicated aspects of the question of life. These are both important and exciting topics that have been discussed in greater detail in other works of this kind, some of which are listed in the Further Reading section near the back of the book. Chapter 8 is entitled "Can we Find Life on Extrasolar Planets?,” which might lead the reader to expect a discussion of the possible signatures of life that are believed to provide reasonable presumptive evidence that life exists on a planet (much as the Galileo spacecraft viewed the Earth from space and detected those molecules in the Earth's atmosphere that are the consequence of abundant life on this planet). Instead, the chapter is about UFOs and alien abductions. The discussion about finding life is a small part of Chapter 9 entitled "Future Searches for Extrasolar Planets."

Plate 14

The book benefits from the artwork of Jon Lomberg. His imagery provides an informative depiction of detection techniques (e.g., color plate 21) as well as a view, through the eyes of an artist, of the landscape of new worlds (e.g., the companions to a pulsar). Color plate 14 is a nice depiction of the range of objects that might revolve around stars, ranging from brown dwarfs to gas and dust. There is a technical error in that the art conveys a sense that the more massive an object, the bigger it is. This is true for matter under "normal" circumstances (e.g., planets), but is not true when matter becomes degenerate. If an object has no internal energy source and is only slightly more massive than Jupiter, at that point it actually gets physically smaller the more massive it is. This is a minor point and not the fault of the artist.

Plate 21

The material is a bit loose on explanatory analogies at various places in the text. For example, the narrative on page 11 about an inebriated golfer confusing a baseball for a golf ball is a poor demonstration of the orbital mechanics that underlies the motion of a star that is caused by the presence of a companion. Use of a hammer thrower, or a rotating seesaw, would have been far more effective and accurate in portraying the underlying physics of the situation.

I found the style of the book to be a bit choppy. For example, in the aforementioned Chapter 8, page 181, there is a heading "How to Find Civilizations Around Other Stars" that has below it a single paragraph of text. That is followed by "Interstellar Spaceships," which commands two paragraphs of text. This is admittedly a matter of personal taste, but I would have preferred a smoother, more integrated style of writing. This same style is evident in the presentation of the color plates. They are not located generally near the relevant text, but rather lumped into two clusters of plates. This lessens the impact and information transfer that the imagery could provide.

The enthusiasm that greeted the first interpretation of companions around other stars as planets is understandable, and indeed that
interpretation may turn out to be correct for some, maybe even all, of these objects. But that interpretation may also be totally incorrect for many, perhaps all, of these companions. Indeed, there is recent evidence that there may be no companion to the star 51 Pegasi. Also, the book includes no mention of a number of detections that have occurred during this time that may be critical to the interpretation of all the newly discovered companions.

The scientific process of clarifying the true nature of these companions is exciting and offers an excellent example of how science works. The opportunity to portray that dynamic is lost in this book as it accepts the early interpretations uncritically, and worse, passes them on as "fact" to the lay public.

The title of the book derives from a line in Pope's *An Essay on Man*. I close with a quote from Pope's *Essay on Criticism*: "A little learning is a dangerous thing, drink deep, or taste not the Pierian spring." This advice is for readers of *Unnumbered Worlds*, as well as a reminder for practicing scientists.

—by David C. Black
(Dr. Black is Director of the Lunar and Planetary Institute.)