

REVIEW OF "JUPITER - The Giant Planet" by Reta Beebe
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In authoring "Jupiter - The Giant Planet" (Smithsonian Institute Press), Prof. Reta Beebe has accepted a tremendous challenge - to encapsulate our current understanding of the entire jovian system and make it understandable to a diverse audience of both technical and non-technical readers. She has succeeded remarkably well, and the book will reward serious readers of all levels of scientific background.

The book is a compact, high quality production, with a handsome cover dominated by Jupiter. The color plates are excellently reproduced and well chosen. The graphics and illustrations are clean and well integrated with the text. Some of the black and white photographs suffer from contrast problems but are mostly adequate for their purpose. A future edition of this work would benefit from using more recent digital versions of the Galilean satellite maps. The text is free of most "old style" typographic errors (I found only one) and also the "spell checker" induced problems so now common even in supposedly high quality publications (e.g. right spelling but wrong word). Is it possible that something so old-fashioned as proof reading was done?

The topics are well organized, starting with a brief, but excellent, historical discussion placing Jupiter in the context of the development of modern physics and astronomy. The core of the book consists of chapters on the Atmosphere and Interior, the Satellites and Rings and the Magnetosphere, followed by a brief conclusion looking forward to future studies, and a set of appendices. Each of the main chapters weaves together the historical background of research in that area, telescopic observations, expectations from theoretical arguments, and the most recent results from the Pioneer and Voyager spacecraft.

Perhaps the most challenging aspect of this work is the commitment to readers of diverse science backgrounds (the book jacket claims "... intended for the general audience, but finds equal use by specialists in the planetary sciences."). This is a tall order. Equations are eschewed. Jargon is kept to a minimum, although some does creep through. The appendices provide a useful guide for the general reader to some of the frequently used scientific concepts, but a short glossary might have been useful as well.

I admit, to being a little put off at first by page long simplified descriptions of such topics as absorption and radiative transfer in the atmosphere or the Lorenz force. As I progressed through the book and put these discussions in context, however, I concluded that the author has succeeded quite well in conveying some very complex physical concepts in relatively plain English. Prof. Beebe does not rely on oversimplified (and frequently misleading) analogies; these are honest attempts by an excellent teacher to explain how things work without mathematics. The best of these efforts, such as the description of ring orbital mechanics and the discussion of forces on charged particles in the magnetosphere, serve to remind us all of the physical intuition and careful thought that underly the equations we use daily. The scientifically sophisticated reader might wish to skip some of this material, but if they are involved in any form of education they would be repaid by studying it. The serious general reader will find in these passages considerable insight into the scientific thought process and perhaps be motivated to dig deeper.

Given the tremendous scope of the disciplines and data sets involved, it is inevitable that any specialist in a given area of Jupiter studies will find a few bones to pick with the author. In areas that I am familiar with I noted a few points of disagreement:

(1) The text implies that older satellite surfaces are dark because of meteoritic infall. However, dark material on Callisto and the other Galilean satellites may well be mostly original rocky/organic material and not meteoritic infall (except in the sense of original accretion),

(2) The latest interpretations suggest that Io is losing most of its heat through direct radiation to space from large, cooling lava flows, not from the elegant system of SO₂ liquid cooled heat engines described in the text.

(3) The Io "flux tube" is discussed as if it was a Pioneer 11 measurement. In fact, the theoretical idea pre-dated the Pioneer and Voyager data - Goldreich and Lynden-Bell developed the "unipolar inductor" model to help explain Io's control of decametric emissions - this history would have fit well with the rest of the theoretical development in this chapter.

(4) The potential for Galileo observations in spite of its high gain antenna problem is, I believe, higher than described in some areas, although this remains to be demonstrated.

(5) Finally, Pele might be surprised to find herself characterized as a "god" a couple of times in the text (better take her some extra gin the next time to the Islands, Reta).

The basic point about the above examples is not that they are "mistakes", but that they are the things one might bring up in a review of a colleague's otherwise excellent paper (e.g. "You obviously haven't seen a copy of my latest paper - I've included a pre-print for your information. " or "hr. Tar and Prof. Feather conclusively demonstrated that my group was right about this"). They serve to illustrate rather that science is continually changing and advancing. In fact, conveying this sense of science as process rather than a collection of stale, agreed-upon facts is perhaps this book's greatest achievement. It is fitting that the book ends with preparations for observing the Shoemaker-Levy 9 impacts and

a description of the many different ideas about what would really happen, some of which were right and some wrong (I hope Beebe publishes a post-impact addendum!). The book brims with a sense of enthusiasm for doing science, conveying the excitement of finally getting a difficult piece fitted into the jigsaw puzzle - as well as the sinking feeling that in the process a couple of other pieces may have gone missing under the sofa.

In summary, I heartily recommend this book to a wide group of readers. It would make an excellent secondary school or university undergraduate study in the application of the scientific method and the history of recent planetary exploration. As part of a graduate survey course it would provide the background and context for much of what Voyager discovered and what Galileo will discover, although supplementary information from more detailed technical sources would be needed. Anyone who appreciates the process of scientific exploration and discovery will find this book a valuable addition to their bookshelf.