species may extend for many meters. Zimmermann stresses vessel length distribution rather than maximum or average vessel length and notes that the xylem generally contains more short vessels than long ones. Hydraulic conductivity varies with the fourth power of the radius of the vessel, and Zimmermann suggests that this parameter should be used in the functional comparison of xylem instead of the usually used vessel area or vessel number. Zimmermann provides thorough coverage of the applicability of the Hagen-Poiseuille equation to the xylem of various taxa and beginning with chapter 3 deals definitively with the cohesion theory for the ascent of sap. He does not spend much time evaluating competing hypotheses (for example, that put forth by Plumb and Bridgman, *Science* **176**, 1129 [1972]). He concludes with a chapter on the effects of pathology on water transport.

The references in the book are rich and mainstream, with good coverage of the older and European literature; citation of the wood science literature is somewhat lacking, however. Overall this volume is a fine and creative contribution that brings many heretofore disperse concepts into a coherent whole.

GRAEME P. BERLYN
School of Forestry and Environmental Studies, Yale University, New Haven, Connecticut 06511

Planetary Science

Physics of the Jovian Magnetosphere. A. J. DESSLER, Ed. Cambridge University Press, New York, 1983. xvi, 544 pp., illus. $29.50. Cambridge Planetary Science Series.

Books on the giant planets tend to be associated with the interpretative phase of major planetary missions and to have a lifetime on the order of the time until the mission's exciting data are superseded by the spectacular findings of the next mission. Thus the giant tome *Jupiter, The Giant Planet* that came out in 1975 in the wake of the Pioneer 10 and 11 missions has been replaced in the magnetosphere-plasma domain by the present volume, whose purview is the data collected by Voyager 1 and 2. Until the interpretative phase of the Galileo orbiter is reached, this volume will serve as the major reference work for researchers and students working in the field.

The book is tightly and rationally organized. It contains 12 papers, eight experimental and four theoretical. The experimental papers present the relevant Voyager data, the results of optical ultraviolet and radio remote sensing, and, in the paper on high-energy particles, the Pioneer 10 and 11 results. Results concerning the magnetic field, thermal plasma, and low-energy charged particles are presented clearly and discussed in depth by authors who were intimately involved with the experiments. A paper on the ionosphere by two Voyager ultraviolet experimenters insightfully compares the Pioneer and Voyager epochs and presents estimates of those ionospheric parameters, such as Pedersen conductivity, that play a basic role in magnetospheric dynamics.

A long paper by Brown, Pilcher, and Strobel, two ground-based optical spectroscopists and one member of the Voyager ultraviolet team, deals with the optical and ultraviolet remote sensing of the Io torus. The paper contains a great deal of "tutorial" material; the same space could have been better used for a more comprehensive and possibly fairer review of the contributions of many other workers, some of whom have been given rather short shrift in the paper. The involvement of a plasma physicist, if only as a consultant, would have done the paper good.

Chapters 7, 8, and 9 constitute a set. The first two chapters are reviews of the radio-astronomy and plasma-wave results, respectively, with the proper combination of authors from ground-based and Voyager groups. The last of the three chapters is the first of the theoretical papers, a review of the theories of radio emission by Goldstein and Goertz. The authors deal with the application of standard plasma-wave theory to the generation and propagation of electrostatic and electromagnetic waves in a magnetized plasma with, of course, Jupiter as the prime example. Of necessity this chapter depends on the following one, a discussion of magnetospheric models that, though to some extent presenting "the view from Rice," gives a fair picture of the generally sorry state of theory concerning the magnetosphere of a giant planet and the outstanding problems that remain to be confronted.

The final two papers deal with the fundamental questions concerning plasma physics that are raised by Jupiter. Vasyliunas deals creatively with the magnetohydrodynamic aspects of the plasma and magnetic-field regime, coupling his theoretical discussion with copious quantities of data gleaned from both the Pioneer and Voyager flybys. The result is an interesting and useful paper that does much more than simply review the published literature. Thorne, in the final paper, views the Jovian magnetosphere and its particle populations from the perspective of plasma kinetic theory. He discusses linear and nonlinear wave theory, including wave-particle interactions, diffusion resulting from the violation of the various adiabatic invariants, and the resonant-type processes that give rise to the broad range of Jovian magnetospheric plasma, particle, and radiation phenomena. Though there is some inevitable overlap between the paper and that of Goldstein and Goertz, the contents are sufficiently different to justify the inclusion of both papers. Thorne's paper is one of the book's highlights.

I can sum up by saying that this book is a useful and valuable research tool. It should be in the library of every researcher and student in the field. The editor is to be commended for bringing the book into being.

AHARON EVIATAR
Department of Geophysics and Planetary Sciences, Tel Aviv University, Ramat, Israel

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