

BOOK REVIEW

Book Review: *Fundamental Planetary Science: Physics, Chemistry and Habitability* (2019) By Jack J. Lissauer and Imke de Pater. Cambridge University Press. ISBN 9781108411981, 650 pages. \$64.99.

The book *Fundamental Planetary Science: Physics, Chemistry and Habitability* by Jack Lissauer and Imke de Pater provides an excellent overview of the interdisciplinary nature of planetary science through the main branches of physics, chemistry, geology, and biology.

Jack Lissauer of NASA Ames is the co-investigator on the Kepler and TESS missions for the search for extrasolar planetary systems and has numerous publications on the habitability and planetary formation theories. He is the authority on protoplanetary dynamical processes as well. Complimentary to Lissauer is Imke de Pater of UC Berkeley, who specializes in ring and satellite formation and dynamics, and adaptive optical systems to study giant planets and their moons. She is also notable for her work on Jovian radiation and magnetospheric environments.

Planetary science is a broad branch of astronomy and indeed has many levels of subdisciplines. The authors' collective backgrounds in planetary science proves this collection of planetary science noteworthy. It is also convenient to have an up-to-date planetary science textbook (since 2015) as many as 16 Solar System missions are expected to occur within the 2020s and 2030s.

By presenting planetary science through a multidisciplinary lens (e.g., chemistry, physics, geology, etc.) with past and current techniques, Lissauer and de Pater provide a valuable resource for the astrophysical, geological, and astrobiological context of our understanding of the Solar System and beyond.

This book has a modular structure comprising of 16 chapters and divided into 5 main themes: (1) astrophysics and dynamics; (2) interiors to atmospheres; (3) planetary classification: from formation to nomenclature; (4) extrasolar astronomy; and (5) astrobiology. Theme 1 provides an overview of the physical interactions encountered throughout the Solar System, including Kepler's laws, motion resonances, orbital mechanics, gravity and tidal effects, and even a small section on stellar properties and nucleosynthesis. Theme 1 also takes an interesting look at the solar wind and heating effects in terms of radiation and magnetosphere dynamics, topics of which are not usually found in most introductory planetary textbooks. In Theme 2, the authors

provide an in-depth look to planetary formation of interiors and atmospheric effects, including ring formation and current theories. This section also does a brilliant job of partitioning the Solar System by planetary type (e.g., terrestrial versus gas giants), which provides a convenient reference for those interested in specific solar system conditions. Theme 3 is a smooth transition from Section 2 in that planetary nomenclature (e.g., definitions of satellites, small bodies, minor planets, etc.) and the formation processes of these bodies are provided in detail here. Theme 4 provides the most up-to-date list of techniques used to observe extrasolar planetary systems, such as astrometry, transit timing, microlensing, photometric techniques to observe the variability of extrasolar planets, and hypotheses on solar system formations depending on stellar properties. Theme 5 looks at several key factors when exploring the subdisciplines of astrobiology, including: biological thermodynamics, the Drake equation and other mathematical probabilities for life and intelligence in the universe, evolutionary theories (including Darwinian theories), and mass extinctions (with other natural disasters that may influence the process of life and evolution).

This collection of knowledge and current theories within a wide range of planetary science can certainly be used as a fantastic resource for scientists in the professional and academic regimes. That is, this book can be used as both a textbook for advanced undergraduate and graduate students, and as a guide for planetary mission background information. Students will welcome its breadth of information regarding current planetary science and observational techniques, while also providing a steppingstone toward what still needs to be discovered in the Solar System. Academic instructors will find the color photograph plates and numerous tables and plots worthy to use in coursework. Overall, with planetary science observations rapidly expanding, it is the authors' unique abilities to intertwine multidisciplinary topics into an easy to understand presentation and highly accessible reference to guide those future planetary science observations.

CAITLIN AHRENS
Arkansas Center for Space and Planetary Sciences
University of Arkansas
Fayetteville, Arkansas
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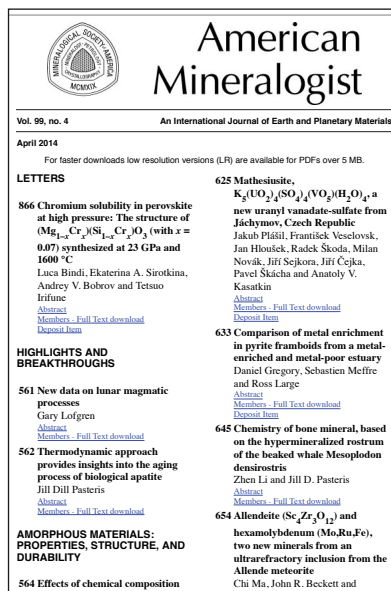
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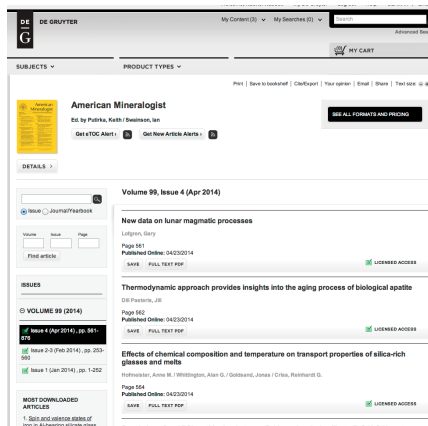
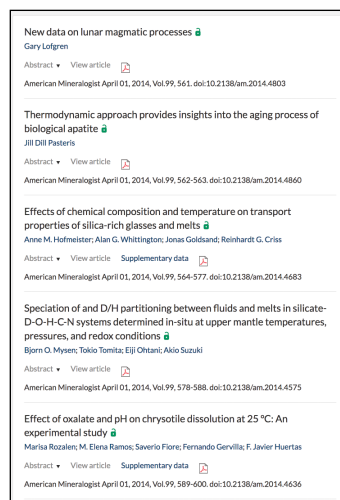
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