

Encyclopedia of the Solar System, 2nd edition, editors Lucy-Ann McFadden, Paul R. Weissman and Torrence V. Johnson, Academic Press, 2007.

BOOK REVIEW, March 2008

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Encyclopedia of the Solar System is a thorough scientific tome, and, as one long interested in this field, I know of no similar reference. At 965 pages and eight pounds in weight, the hardcover book resembles the single-volume Columbia encyclopedia in size, and can be used as a reference in the same way. Over fifty authors contribute to this updated version, and there are hundreds of color photographs, charts and tables. (*Note that a shorter but different book with the identical name, written by Roger Smith, was printed in 2000.*)

This book, first published in 1999, includes the usual bedrock fundamentals about our portion of the universe and chronicles the last decade of astronomical discoveries. As the preface notes, in just the last 10 years an international fleet of spacecraft have circled Mars and two NASA rovers continue to roam its surface.

Probe *Galileo* went to Jupiter, and the *Deep Impact* and separate *Stardust* missions have brought back actual comet fragments. *Cassini* continues to send data from the Saturn system, and the *Huygens* probe was sent the moon Titan. Other probes orbited and then touched down on the asteroids Eros and Itokawa. Further, scientist's increasingly sophisticated telescopes continue to make startling discoveries. Even with government funding cuts for many space programs, at no time in human history has the rate of space discovery been so rapid.

Encyclopedia of the Solar System begins with an overview of our system and its relationship to the greater galaxy. Individual chapters are then devoted to the origin of the solar system and the history of solar system studies. Subsequent chapters examine solar winds, meteorites, planetary satellites and the atmosphere of giant planets (Jupiter, Saturn, Uranus and Neptune), plus planetary rings, solar system dust and solar system dynamics (a.k.a. Regular and Chaotic Motion).

Planetary moons are covered at length, with chapters on the Earth's moon, as well as the moons Io, Europa, Ganymede, Callisto, Titan and Triton. Recent theories regarding possible repositories of ice existing on our own moon are examined and discussed in the context of future Moon missions that now under consideration by several nations, including India, China, the United States and Russia.

Of particular value, *Encyclopedia of the Solar System* focuses on topics not thoroughly covered in many general texts. An entire chapter analyzes asteroids, noting that these solid bodies that orbit the Sun have no atmosphere, and were first discovered only in 1801. For five decades following only four more asteroids were found--largely because of the poor quality of telescopes. Today's scientists use photographic means in conjunction with light wave or radio wave analysis. These methods are then coupled with computer analysis. In comparison to the few known asteroids in the nineteenth century, there are now over 120,440 numbered asteroids.

Other sections cover new fields of study such as astrobiology, planetary volcanism, extrasolar

planets, and remote chemical sensing using nuclear spectroscopy. Planetary radar and techniques for measuring the solar system using radio wavelengths are discussed. As with asteroids, vast advances have been made in both discovering and analyzing comets. Separate chapters focus on the evolving fields of comet chemistry and physics, as well as comet populations and dynamics.

None of this information was known before astronomers began using telescopes that allow them to “look through” solar and interplanetary dust to see otherwise obscured comets and asteroids. Chapters even examine a newly discovered ring of dust that follows Earth’s orbit and a solar wide field of small particles known as the Zodiacal Dust Cloud.

Much of the detailed information comes from the five successful landers that have investigated the surface of Mars since 1976. These landers used rovers that carried engineering cameras and spectrometers for measuring the chemical composition of surface materials. The current mission in 2004 sent *Spirit* and *Opportunity* to explore the surface. They have far exceeded their 3-month design life, and in their third year of operation, have explored over 7 km.

The data that these rovers obtain is based on robust and sophisticated instrumentation (what NASA calls their geology toolkits), which include color cameras, a microscope imager, thermal emission spectrometers and a device that grinds into rocks to determine their composition. Perhaps the most exciting evidence found by the ongoing mission is evidence that salty water once existed. For current information, see <http://marsrover.nasa.gov/home/index.html>.

Encyclopedia of the Solar System discusses at length --for the first time-- the rich geology, mineralogy and geochemistry of Mars. A chapter covers the history and surface interactions of the Mars atmosphere, including past and present climates. There is extensive analysis of the most recent conclusions that fluids shaped the surface of Mars during all its primary epochs.

A further chapter delves into Mars tectonics, canyons, erosion and deposition, volcanoes and impact cratering. These new (and updated) chapters are some of the most exciting for anyone who has followed the endless scientific debates about Mars. Many of the earlier controversies have been conclusively settled, yet mysteries remain. The recent discovery of methane in the Mars atmosphere has not been fully explained, and debates about subsurface water deposits continue within the scientific community—probably only to be resolved if future missions are able to probe deeply enough into subsurface layers.

A thorough appendix is included, which details all international planetary exploration missions, and includes further sections on selected astronomical constants and the physical and orbital properties of the Sun and planets. Similar data is included for known satellites. The appendix includes a lengthy discussion on recent proposals to redefine planets. There is also an extensive glossary and index.

Consequently, *Encyclopedia of the Solar System*—in revision for eight years—is a thorough reference for both scientists and laymen. To its great credit, *Solar System* acknowledges—indeed, assumes—that portions of its material will soon be out-of-date. Even now, the *New Horizons* spacecraft is on its way to the Pluto/Charon system; *Messenger* is on its way to Mercury; *Rosetta* is blasting toward the comet Churyumov-Gerasimenko; and new international probes are working in the vicinity of Venus and Mars. Astronomy is in its heyday, and the *Encyclopedia of the Solar System* makes its discoveries highly accessible.