

## The Boosting of the Planets

### Space Technology and Planetary Astronomy.

JOSEPH N. TATAREWICZ. Indiana University Press, Bloomington, IN, 1990. xviii, 190 pp., illus. \$29.95. Science, Technology, and Society.

Recent events in space policy make *Space Technology and Planetary Astronomy* especially interesting. With a presidential panel suggesting that the National Aeronautics and Space Administration renew its emphasis on unmanned space science, this history of politics, technology, and science will be useful to practitioners and concerned observers. If nothing else, the book warns space scientists to be extremely wary of the political nature of the research they pursue and of the institutions that promise support. As planetary astronomers learned in the 1960s and 1970s, support for their activities waxes and wanes depending on the strength and direction of political forces and institutional needs.

As the author forewarns, this history of planetary astronomy lacks a theoretical framework such as academics in science and technology studies appreciate. Instead, the book takes a narrative approach and recounts the rejuvenation of planetary science as a result of the United States' efforts to win international prestige and technological supremacy after the Russian launch of the Sputnik satellite in 1957. It begins with a discussion of the severe erosion of prestige and support for planetary astronomy early in the 20th century, when traditional astronomers seemed to have run into a roadblock concerning both observation and theory. Ground-based studies of planets were limited by technology, and theories of planetary origin remained highly speculative. The debate about the existence of canals on Mars and the red planet's habitability did little to make planetary astronomy popular among other professional astronomers. Meanwhile, new techniques and approaches to stellar and galactic astronomy made these non-planetary fields exciting by providing fascinating avenues for studying the origin and development of the universe. In an age of astrophysics, planetary observations seemed mundane and irrelevant.

Though some military interest in the planets emerged after World War II—for learning about weather patterns elsewhere that might help explain the earth's, and for de-

veloping techniques to help distinguish missiles from meteors—planetary astronomy gained its major impetus from the new space program established in 1958. As NASA administrators strove to develop manned and unmanned programs, they realized that much remedial scientific work needed to be done regarding the moon and planets. This need contributed to the creation of alliances within NASA and the National Science Foundation to support ground-based astronomical studies. Such support even included funding to build ground-based facilities for planetary astronomers. Though it caused some grief to administrators, who had to justify to Congressional investigators why the space agency should build telescopes on the ground, NASA funding for such programs peaked at almost \$6 million in 1966. But as the Apollo manned lunar landing program fell from grace once the initial objectives of reaching the moon were achieved in 1969, so did support for planetary astronomy (as well as for most other fields of space science). The planetary program in the early 1970s achieved a modest level of stability, but even that stability dissolved late in the decade and into the 1980s. So went the enthusiasm for this rejuvenated field of science.

*Space Technology and Planetary Astronomy* best suits readers who have some familiarity with the basic history of the space program. The author introduces scores of participants without providing even thumbnail biographies of them, so an unknowing reader might not appreciate why some people are more significant than others. In addition, readers should beware that the book is more about ground-based planetary astronomers and their institutional and political struggles than about the physicists, geologists, and members of other disciplines who explored the planets vicariously with instruments carried by space probes.

Even with these limitations, the book reminds us of an important lesson in the postwar era of big science: that government policy may lead initially to tremendous support for various fields of science and technology. This enthusiastic support often leads to an implicit social contract of continued future support between the government and practitioners. Such a contract, however, is easily broken as government policy

changes—for example, when the political urgency of demonstrating technical supremacy over an ideological foe no longer seems so important in a Vietnam War-weary America. This lesson will be learned repeatedly as government policymakers commit and withdraw resources for both military ("Star Wars" weapons) and civilian (the Superconducting Super Collider) research efforts. Practitioners beware!

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## Institutional Arrangements

**The Kaiser's Chemists.** Science and Modernization in Imperial Germany. JEFFREY ALLAN JOHNSON. University of North Carolina Press, Chapel Hill, 1990. xii, 279 pp., illus. \$39.95.

In 1905 Emil Fischer, Walther Nernst, and Wilhelm Ostwald proposed an Imperial Institute for Chemistry to solve mutual problems. These disciplinary leaders hoped to link pure and applied science by building new relationships between science and industry. Like many of their colleagues, they found balancing research and teaching frustrating. They also hoped to find support for fields neglected in Germany such as inorganic, physical, and analytic chemistry. Since the existing academic system would not accommodate these needs, the three sought



Emil Fischer in his laboratory, 1905." [From *The Kaiser's Chemists*; Max-Planck-Gesellschaft Photo Archive]

new institutional arrangements that could. They looked to the German chemical industry and the state bureaucracy to help establish a new centralized research institution with government funding. By 1908 they had found support from Kaiser Wilhelm, who was looking for new ways to bolster his image. Instead of one centralized institution that could promote research in areas beneficial to industry and neglected in the universities, three different, privately funded chemical institutes were built as part of the Kaiser Wilhelm Society, established in 1910. Soon those promoting the new relationship between chemical research, government, and business were using the new institutes for war-related research.

Jeffrey Johnson analyzes these developments in terms of "modernization" and a variant he terms "conservative modernization." Scholars writing about modernization assume that science played a crucial role, but Johnson tries to investigate that role. For Johnson modernization concerns international competition and the increasing links among government, business, and science. Fischer, Nernst, and Ostwald noted the danger that Germany might fall behind other nations when they promoted their ideas for institutional reform. Johnson terms the eventual success of their efforts in the form of the Kaiser Wilhelm Society "conservative modernization" because institution-builders and their collaborators in business and government carefully shielded older institutions from newer ones. They insulated universities and professors from the new Kaiser Wilhelm

Society, just as they protected the East Elbian aristocracy from the dangers of the modern world.

Solid evidence supports these points. To open up new research positions, reformers had to establish new institutions, since universities would not change their structures. Reformers relied on private funding because the state was unable to increase taxes without changing its organization and relationship to society and economy. The three chemical institutes and their directors had difficulties regularizing their relationships with the universities and the Berlin Academy of Science. The process of founding the institutes also represented a "Prussianization" of the institutes because they were insulated from universities in the other states of Germany. Moreover, the institutes provided research niches for outstanding scientists whose disciplines, religions, or genders prevented successful university careers. Otto Hahn and Lise Meitner come to mind. And international competition has indeed tied science increasingly to the military.

Although Johnson provides an exemplary description of the development of new science institutions, his key analytical devices do not work well. The concept of "modernization" is highly contested, especially among German historians. A common view that the history of Imperial Germany from 1890 to 1918 can best be explained by reference to feudal remnants preventing proper development through strategies including "conservative modernization" is more evaluative than analytical. It implies a

proper path for change. Nor does it do justice to the complex negotiations that created new institutions linking the inside of science to a rapidly urbanizing and industrializing nation.

The dynamism of science in Imperial Germany may have resulted from the wide variety of science institutions, which, because they were partially insulated from one another, could make individual responses to their rapidly changing environments. Johnson quite nicely describes the addition of yet another institutional layer.

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## Books Received

**Abstraction and Aging.** A Social Psychological Analysis. Jason S. Lee. Springer-Verlag, New York, 1991. xii, 113 pp., illus. Paper, \$39. Recent Research in Psychology.

**Adolescence and Puberty.** John Bancroft and June Machover Reinisch, Eds. Oxford University Press, New York, 1990. xiv, 303 pp., illus. \$39.95. Kinsey Institute Series, vol. 3.

**Channels, Carriers, and Pumps.** An Introduction to Membrane Transport. Wilfred D. Stein. Academic Press, San Diego, CA, 1990. xiv, 326 pp., illus. \$59.95.

**Chaos in Classical and Quantum Mechanics.** Martin C. Gutzwiller. Springer-Verlag, New York, 1990. xiv, 432 pp., illus. \$39.95. Interdisciplinary Applied Mathematics, vol. 1.

**Chaos II.** Hao Bai-lin World Scientific, Teaneck, NJ, 1990. xii, 737 pp., illus. \$76; paper, \$34. Reprint with revisions, 1984 ed.

**Contexts of Competence.** Social and Cultural Considerations in Communicative Language Teaching. Margie Berns. Plenum, New York, 1990. xii, 185 pp., illus. \$34.50. Topics in Language and Linguistics.

**Counting Process Systems.** Identification and Stochastic Realization. P. J. C. Spreij. Centrum voor Wiskunde en Informatica, Amsterdam, 1990. viii, 135 pp. Paper, Dfl. 38.50. CWI Tract 71.

**Culture and Cognitive Development.** Studies in Mathematical Understanding. Geoffrey B. Saxe. Erlbaum, Hillsdale, NJ, 1991. x, 212 pp., illus. \$29.95.

**The Dynamic Planet.** W. G. Ernst. Columbia University Press, New York, 1990. x, 281 pp., illus. \$30; paper, \$17.

**Educational Values and Cognitive Instruction.** Implications for Reform. Lorna Idol and Beau Fly Jones, Eds. Erlbaum, Hillsdale, NJ, 1991. x, 470 pp., illus. \$74.95.

**Elements of General and Biological Chemistry.** John R. Holm. 8th ed. Wiley, New York, 1991. xx, 537 pp., illus. \$48.95.

**Elements of Medical Statistics.** F. Bisset Hawkins. Science History (Watson), Canton, MA, 1990. xxii, 161 pp., illus. \$20. Resources in Medical History. Reprint, 1829 ed.

**Forage in Ruminant Nutrition.** Dennis J. Minson. Academic Press, San Diego, CA, 1990. xviii, 483 pp., illus. \$89. Animal Feeding and Nutrition.

**Mycoses in AIDS Patients.** Hugo Vanden Bossche et al., Eds. Plenum, New York, 1990. xii, 337 pp., illus. \$79.50. From a symposium, Paris, Nov. 1989.

**Neutral Proteases of Mast Cells.** L. B. Schwartz, Ed. Karger, New York, 1990. viii, 165 pp., illus. \$126. Monographs in Allergy, vol. 27.

**Problems and Wonders of Chiral Molecules.** Miklós Simonyi, Ed. Akadémiai Kiadó, Budapest, 1990. x, 400 pp., illus. \$48.

**Random Walk in Random and Non-Random Environments.** Pál Révész. World Scientific, Teaneck, NJ, 1990. xiv, 332 pp. \$38.

**Serotonin Receptor Subtypes.** Basic and Clinical Aspects. Stephen J. Peroutka, Ed. Wiley-Liss, New York, 1990. x, 236 pp., illus. \$69.95. Receptor Biochemistry and Methodology, vol. 15.



"'Science in Uniform': Fritz Haber (pointing) among the German gas troops, probably around 1916-1917." [From *The Kaiser's Chemists*; Max-Planck-Gesellschaft Photo Archive]