

BOOKS

Cometary Science and Cometary Lore; Even Halley and Newton Were of Their Time

Comets, Popular Culture and the Birth of Modern Cosmology

▶ Sara Schechner Genuth
Princeton U. P., Princeton, N.J.,
1997. 365 pp. \$49.50 hc
ISBN 0-691-01150-8

Reviewed by Michael J. Crowe

Not only has the decade of the 1990s been rich in the number of noteworthy comets that have blazed into view, there have also appeared two richly detailed historical studies of cometary science. In 1991, astronomer Donald Yeomans brought out his *Comets: A Chronological History of Observation, Science, Myth and Folklore* (Wiley). As its title suggests, the book surveys cometary observation and theory from antiquity to the present and also gives some attention to the place of cometary lore and science in civilization. Now, historian of science Sara Schechner Genuth, in *Comets, Popular Culture and the Birth of Modern Cosmology*, has advanced the frontier of historical research.

After surveying scientific, religious and popular beliefs about comets in the period before the scientific revolution, Schechner Genuth's book concentrates on 17th- and 18th-century ideas and beliefs about these spectacular astronomical objects. The traditional account of the development of cometary science in these two centuries centers on how Isaac Newton and Edmond Halley first brought comets under the sway of science—Newton by showing that comets move in conic sections and Halley by demonstrating that at least some comets are periodic.

Without denying the scientific contributions made by these two giants, the tale told in this volume turns out to be far richer and more nuanced than one might expect. One sees that New-

ton and Halley, rather than viewing cometary science as irrelevant to religion and to astrological claims about comets as harbingers of destruction or foretellers of prosperity, were themselves intent on deciphering God's use of comets for the creation, alteration or destruction of worlds. Halley, for example, sought to explain the biblical deluge and to describe the final conflagration as caused by comets hurtling toward Earth.

Halley's master, Newton, went still further. For example, he formulated a theory that comets play a role in the divine economy by transporting and depositing fluids onto the planets and suns. Moreover, in various writings, not all published, Newton "intimated that comets were divine agents destined to reconstitute the entire solar system, to prepare sites for new creations, and to usher in the Millennium," writes Schechner Genuth. Readers unaware of the scriptural, alchemical and metaphysical aspects of Newton's thought uncovered by scholars in recent decades should find the chapter on Newton a revelation.

Schechner Genuth sets the stage for her discussions of Newton and Halley by describing how, during the 17th century, educated persons came to disparage the traditional divinatory aspects of comets, not simply for scientific reasons but also because they disliked the political, social or religious purposes various authors associated with comets. And she traces the same blending of scientific with religious, teleological and apocalyptic concerns exhibited by Newton and Halley in a variety of Enlightenment Newtonians, including William Whiston, Thomas Wright, Johann Lambert, Immanuel Kant, William Herschel and Pierre Simon Laplace. Gradually, such approaches fell from favor in the scientific community. She cites writings from the 1830s by the astronomer François Arago to indicate that, by then, such studies had become outmoded.

This is a thoroughly researched and fully documented book supplemented by an extensive bibliography and a useful index. It is a work of serious scholarship that is rich in fascinating material. It recreates a world that has now largely but not entirely passed away, and it thereby shows that differ-

ent ages have assigned comets diverse and dramatic roles. Judiciously selected quotations and 53 illustrations, some exceptionally striking, add to the pleasure of reading this very engaging story, which is filled with surprises, ironies and fresh insights.

Bombshell: The Secret Story of America's Unknown Atomic Spy Conspiracy

▶ Joseph Albright
and Marcia Kunstel
Times Books (Random House),
New York, 1997. 399 pp. \$25.00
hc ISBN 0-8129-2861-X

We have known of atomic espionage almost as long as we have known of the atomic bomb itself. Within a decade of Hiroshima and Nagasaki, Klaus Fuchs, Alan Nunn May, Julius and Ethel Rosenberg, David Greenglass and Harry Gold had been identified, tried and convicted as spies for the Soviet Union. Indeed, the judge in the Rosenberg trial maintained, as he condemned them to death, that their actions had brought World War III closer.

The embodiment of evil seems clear. Try now to see the situation from a different perspective: Capitalism had flung the United States into the Great Depression, and it took World War II to enable the nation to climb out of its hole. Might not the economy falter again after the war in the hands of the capitalists, who might once more look to war to restore economic vigor? With the invention of nuclear weapons, the carnage would be awesome. World peace and stability thus mandated that nuclear weapons be acquired as soon as possible by the Soviet Union, the likely adversary of the US.

This was the thinking of Theodore Alvin Hall, the only known American scientist to assist the USSR in creating its copy of the Manhattan Project. Born in 1925 Hall was a precocious New York City youth who found the ideals of socialism and communism attractive and who thought that they were being successfully implemented in the Soviet Union. After two years

MICHAEL J. CROWE is a historian of science at the University of Notre Dame. His books include *The Extraterrestrial Life Debate 1750-1900*, *Theories of the World from Antiquity to the Copernican Revolution* and *Modern Theories of the Universe*.

at Queens College, he transferred to Harvard, from which he graduated in physics at age 18; he was immediately recruited for Los Alamos, and he arrived there in January 1944.

At this time, the bomb fabrication laboratory was less than a year old, and weapons design was still in a state of flux. Hall helped first to determine the fission cross section of uranium-235 for the gun-type weapon and then to assess the uniformity of the implosion wave in the plutonium model. The youngest scientist on the hill thus had remarkably valuable technical details to offer the Soviets, which he did toward the end of his first year, while on leave from the lab. Even had the compartmentalization of information been imposed at Los Alamos, as the project's head, Leslie Groves, initially desired, it seems that Hall's knowledge would not have been appreciably restricted.

Soviet intelligence named Hall "Mlad," which is "young" in Old Slavonic, and it called the Manhattan Project "Project Enormoz," which needs no translation. Recently opened Soviet archives suggest that Hall's (and Fuchs's) espionage was key to the path followed by Igor Kurchatov that led to Joe-1 in 1949.

After the war, Hall earned a PhD from the University of Chicago, switched from nuclear physics to biological microphysics and conducted research in Chicago, New York and, from 1962, Cambridge, England, where he is now retired.

US Army Intelligence cracked enough wartime cable traffic from the Soviet consulate in New York for the Federal Bureau of Investigation to be convinced by 1950 of Hall's espionage. Neither surveillance nor interrogation gave the authorities any means of indicting him, however, for the US could not reveal its decryption successes. At the height of the Rosenbergs' trial (for passing relatively trivial nuclear information), Hall was frightened, and, although unrepentant, he continued to fear prosecution for much of the next four decades.

With the collapse of the Soviet Union and the end of the cold war, the intelligence services on both sides of the Iron Curtain sought to burnish their images by parading their successes, thereby justifying their budgets before a sometimes hostile public. Thus, the US National Security Agency released many once-classified decryptions that mention Hall, Fuchs, Julius Rosenberg and others, while the KGB produced "documentaries" with a large propaganda content and allowed historians into its archives and permitted its officers to give interviews. In a related domestic controversy over who

played the critical role in the development of the Soviet bomb—the scientists or the spooks—Soviet nuclear physicists also have spoken openly about their work and have written articles for US journals.

The authors of *Bombshell*, Joseph Albright and Marcia Kunstel, an award-winning husband-and-wife team of veteran foreign correspondents, mined these now-open sources. They also conducted numerous interviews with Hall and his wife, Russian physicists and intelligence agents and far too many unnamed "confidential sources." They tell an exciting and credible tale, restoring respectability to espionage literature, which had been tarnished by retired spymaster Pavel Sudoplatov in his *Special Tasks: The Memo of an Unwanted Witness: A Soviet Spymaster* (Little, Brown, 1994). Despite some factual errors, a sometimes breathless style, the awkward footnoting used in trade books and an occasional peculiar phrase (bright theoreticians are called "double domes," for example, and the University of Chicago is referred to as "an academic halfway house for former Manhattan Project scientists"), Albright and Kunstel have written an interesting and important historical work. Was Hall a despicable traitor or a visionary who recognized that nuclear parity would reduce the likelihood of war? They make no judgments. Were there other, yet unnamed American spies within the Manhattan Project? Possibly.

LAWRENCE BADASH

University of California, Santa Barbara

The Einstein Tower: An Intertexture of Dynamic Construction, Relativity Theory and Astronomy

▶ Klaus Hentschel
Translated by Ann M. Hentschel
Stanford U. P., Stanford, Calif.,
1997. 226 pp. \$45.00 hc
ISBN 0-8047-2824-0

The history of physics is often written as that of the singular discoveries of its outstanding heroes. Rarely does one find accounts that focus on failures or on the lesser figures, and even more rarely does history depict physics as a risky, collective enterprise that may, like the Tower of Babel, either succeed or fail. *The Einstein Tower* by Klaus Hentschel, a young but already internationally renowned historian of physics at Göttingen University, provides elements of such a con-



THE EINSTEIN TOWER: An effort to verify general relativity. (Courtesy of Klaus Hentschel, University of Göttingen.)

textual history of physics.

What was the significance of the Einstein Tower for the history of the theory of relativity? The answer is not obvious, even if one already knows that the Einstein Tower refers to an observatory built, according to the plans of Erich Mendelsohn, in Potsdam in the year 1921, to allow the German astronomer Erwin Finlay Freundlich to attempt to verify Albert Einstein's general theory of relativity. After all, neither the Einstein Tower nor Freundlich played a prominent role in the astronomical confirmation of general relativity.

Why then dedicate a book to such an apparently obscure subject? The subtitle, "An Intertexture of Dynamic Construction, Relativity Theory and Astronomy," is of as little help as the introduction, which announces a treatment of ten "interwoven descriptive levels." But despite such trendy terminology, Hentschel has succeeded in writing a very readable account of certain hitherto neglected aspects of the early history of general relativity, made more fascinating by the eccentric perspective that his account takes. By focusing on Freundlich, Hentschel's study reveals that the success story of general relativity depended on much more than Einstein's ingenious intuition and a few crucial observational tests.

The early history of general relativity was also a struggle against the scientific establishment. That establishment was not only peopled, as one may imagine, by conservative scientists adhering to old-fashioned ideas,