

Zeiss projectors were relatively expensive at this period. It was the dream of American entrepreneur, educator, and astronomy enthusiast Armand N. Spitz to make planetarium projectors widely available around the world. Although he was not the first to conceive of or manufacture the so-called pinhole projector, Spitz successfully brought it to a broad audience after World War II. By 1945, he had built his model-A projector at his home; it projected about 1000 stars whose brightness extended down to the fourth magnitude. Eight years later, he had sold his 100th projector worldwide.

Although Spitz projectors fueled an increase in planetarium building, it was *Sputnik I* and *Sputnik II* that greatly expanded the market for his machines. The launch of those Soviet satellites prompted lawmakers to pour money into science education in unprecedented amounts. The planetarium, as Marché argues, acquired a novel and major significance in the US, and hundreds were built for schools and colleges. Planetaria were also put to new use in the 1960s—for example, as training aids for the Apollo astronauts.

But Marché does not focus on just the hardware and its builders. He also explores in detail the kinds of presentations visitors could experience in planetaria and the reasons for the shifts in their content over the years. A particularly interesting development was the first planetarium light show. As Marché recounts, the light shows grew out of a series of sound experiments in the late 1950s by composer Henry Jacobs and filmmaker Jordan Belson in San Francisco's Morrison Planetarium. The Vortex performances, as they were termed, soon became very controversial and sparked debate about the appropriate and inappropriate uses of planetaria. Marché also traces the establishment of a community of planetarium operators, lecturers, and managers and their attempts to develop professional standards and journals. He pays attention to the composition and nature of the workforce; in so doing, he demonstrates the field's depressing extent of discrimination against women, particularly in the 1930s and 1940s.

Although the prose in *Theaters of Time and Space* occasionally reflects the book's origins as a doctoral thesis, the author's arguments are clear and flow from a great deal of careful research that includes an impressive use of archives. Marché has written an original and significant study that sets the development of planetaria in a broad

context. His book deserves a wide readership beyond planetarium specialists.

Robert W. Smith
University of Alberta
Edmonton, Canada

Kristian Birkeland: The First Space Scientist

**Alv Egeland and
William J. Burke**
Springer, New York, 2005. \$109.00
(221 pp.). ISBN 1-4020-3293-5

In the media the launch of *Sputnik I* often defines the beginning of the space age and the associated exploration of space beyond Earth. However, the roots of space physics itself go farther back. In *Kristian Birkeland: The First Space Scientist*, Alv Egeland and William Burke, both well-established space physicists, present the scientific work of the Norwegian physicist.

Birkeland (1867–1917) is a major figure in Norwegian science but is less well known outside Scandinavia. Although his insight and understanding of classical electromagnetic theory were remarkable—he provided one of the first general solutions to Maxwell's equations—he chose to apply his talents to experimental physics, and his primary interest was auroral research. He obtained significant funding from the Norwegian government for an ambitious observational program. At the time Norway was part of Sweden, and Birkeland, in his grant application, appealed in part to nationalistic feelings by arguing that it was important to show that Norwegian science was at the forefront internationally.

Birkeland was also an entrepreneur. He realized that additional income from applied projects was needed to support his basic research. He formed or participated in numerous enterprises, including the building of an electromagnetic rail gun that he tried to sell to the English and French governments, but it was his method for making fertilizer that brought him financial independence. His business ventures are interesting reading, and I found myself reflecting on the similarities between Birkeland's approach and how scientists today try to fund space research at universities.



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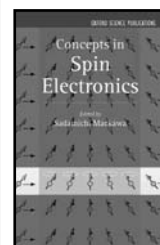
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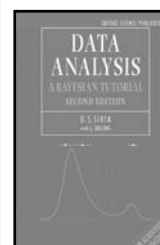
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