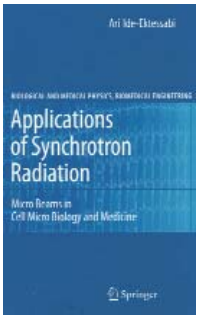
medical applications of such devices and could also serve as a reference for interested scientists and students. Although *Applications of Synchrotron Radiation: Micro Beams in Cell Micro Biology and Medicine* by Ari Ide-Ektessabi, a professor at Kyoto University's International Innovation Center in Japan, covers some of its material well, it does not succeed in filling the gap.



The book is split into two parts. In the first, the author offers brief coverage of synchrotron radiation, x-ray fluorescence (XRF), x-ray spectroscopy, detector basics, and beamline layouts. In the second, he discusses biomedical applications, from the structurally straightforward analysis of single cells to the more complex analysis of tissue sections. The book's subtitle is broad and may be misleading to some readers because the text's contents are, perhaps necessarily, more narrow. The author limits his scope to a discussion of hard XRF microscopy and microspectroscopy. He omits such areas as soft x-ray microbeams, microbeam irradiation, and microdiffraction, which is a good choice because it would be difficult for him to cover those diverse areas comprehensively, but it still may disappoint some readers.

Applications of Synchrotron Radiation, unfortunately, covers its subject matter unevenly. The author focuses on experiments and instrumentation with which he has experience, and he uses that experience to provide some well-detailed experimental descriptions. However, several critical technologies and developments either have been omitted or are mentioned only in passing. For example, Ide-Ektessabi does a good job describing the approaches used to analyze XRF spectra, but he does not cover x-ray focusing optics, even though the technique has relevance in the generation of microbeams and has been critical in propelling x-ray microscopy forward. His topic selectivity continues into the discussions of experimental details in that he does not present the broad range of options and necessary considerations for both sample preparation and experimental configuration. For instance, an adequate discussion of artifacts associated with chemical fixation is absent, despite the fact that the preparation technique is used almost exclusively throughout the described experiments. Cryogenic techniques to probe frozen hydrated samples, and thus avoid fixation artifacts, or to investigate freeze-dried samples are not mentioned at all.

Moreover, a number of comments in the book are incorrect, and some are severely misleading. For example, the author repeatedly states that x-ray microprobe analysis is nondestructive. While in some cases radiation damage may not become apparent, that statement is not true for biological samples in general. In particular, radiation damage must be taken into account in microspectroscopy.

The descriptions of the biomedical applications are the best part of the book, and the author's hands-on expertise does make a difference. The applications, such as to metals in embryonic stem cell differentiation or in neurodegenerative diseases, are most interesting and relevant, and the procedures and approaches are explained well. Yet Ide-Ektessabi sometimes makes sweeping conclusions drawn from what seem to be limited data sets; at other times he leaves the reader perplexed by presenting observations without interpretation. That part of the book is also hampered by the somewhat dated nature of the featured experiments and instrumentation, a particularly unfortunate oversight in a rapidly evolving field. For instance, today's instruments can resolve intracellular distributions of metals and other elements on the level of individual organelles—well below what is depicted in the book. That spatial resolution clearly has a major impact on the types of biological applications that are possible.

The biological and biomedical applications of x-ray microprobe analysis represent a growing, vibrant area of research in which new instrumentation and applications are constantly being developed. For a detailed discussion of technical aspects of XRF, albeit one not focused on biomedical applications or on microprobes, interested readers can consult the *Handbook of Practical X-Ray Fluorescence Analysis* (Springer, 2006), edited by Burkhard Beckhoff and colleagues. For a glimpse at the numerous studies being carried out, readers need only turn to one of several recent reviews on the subject matter, such as Christoph J. Fahrni's article, "Biological Applications of X-Ray Fluorescence Microscopy: Exploring the Subcellular Topography and Speciation of Transition Metals," in the April 2007 issue of *Current Opinion in Chemical Biology*.

Unfortunately, as much as interested scientists and graduate students may long for a comprehensive book on the applications of synchrotron radiation, they may have to wait a little longer.

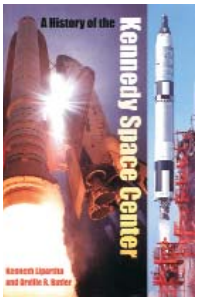
Stefan Vogt
Argonne National Laboratory
Argonne, Illinois

A History of the Kennedy Space Center

Kenneth Lipartito and Orville R. Butler
U. Press of Florida, Gainesville, FL, 2007. $39.95 (478 pp.). ISBN 978-0-8130-3069-2

Kenneth Lipartito and Orville R. Butler's *A History of the Kennedy Space Center* is the most comprehensive review ever done of the nation's rocket-launch center. It traces the program from the US Bumper rocket initiative in the late 1940s to the space shuttle *Columbia* disaster in 2003 to the International Space Station (ISS) and beyond.

Lipartito, a professor of history at Florida International University, and Butler, an associate historian at the American Institute of Physics, discuss the interactions among the researchers, developers, and manufacturers, and their disdain at attempts by the operations engineers and technicians at NASA's Kennedy Space Center (KSC) to give input in the design and manufacturing processes. Development centers have rarely taken operations requirements of the space program into consideration in their design process; that omission has led to inefficiencies and costly delays. Also, it took many years for KSC to refute the space hardware designers' "ship-and-shoot" mentality, that is, the philosophy that once a rocket or payload has been shipped, it's essentially ready to go. Management approaches and techniques vacillated from the early German hands-on operations to US Air Force program management methods, and they eventually incorporated elements of both.



The first director of KSC, Kurt Debus (July 1962–November 1974), characterized by many as the center's "father," was a member of Werner von Braun's team at Peenemünde in northern Germany. A charismatic leader who carried a dueling scar on his face from his college days in Germany, Debus was

considered by his US colleagues as a "hands-on rocket guy." He brought with him the German rocket tradition that stressed close, vertical integration of all parts of the process of designing, fabricating, preparing, testing, and firing rockets. Debus's initial in-house approach allowed close working relationships among designers, builders, testers, and operators. But as rockets became bigger, missions more complex, and schedules tighter, even Debus included elements of the air force model of program management. From 1963 to 1968, leading up to *Apollo 11*, the workforce of 8000 launch-operations workers and 10 000 support workers were contractors, supervised by 800 civil servants. The need for government workers to be the continuing thread in the fabric of the operations workforce continues to this day.

The book begins with the most important launch ever from KSC: *Apollo 11*, the first US manned lunar landing mission, viewed by a million people onsite and by a worldwide television audience. Preceding that event were many rocket firings, from the 24 July 1950 successful launch of the *Bumper-8*, a *V-2* combined with a WAC (Women's Army Corps) Corporal second-stage rocket, through the many launches of *Redstone*, *Jupiter*, *Delta*, and *Atlas* rockets from Cape Canaveral. While the operations at Cape Canaveral were taking place nearby, engineers and technicians were constructing the infrastructure of KSC and designing and building the ground-support equipment for the huge *Saturn* rockets, with the US Army Corps of Engineers managing the actual facilities construction.

Before KSC became NASA's independent operations center in 1962, it was the Marshall Space Flight Center's launch operations directorate. The center was responsible for the planning and supervision of the integration, test, checkout, and launch of vehicles. President Lyndon B. Johnson renamed the center the John F. Kennedy Space Center on 29 November 1963, just a week after Kennedy's assassination. A communications satellite, *Relay I*, launched into orbit from Cape Canaveral the year before, covered Kennedy's funeral as the world's first real-time television event.

Debus has been succeeded by eight KSC directors, several of whom were instrumental in the back-and-forth shifts in management approach from the German hands-on method to the air force project management system as resources, programs, and missions changed. The loss of the space shuttle *Challenger* in January 1986 occurred on Richard Smith's watch (September 1979–August 1986), and Forrest McCartney (August 1986–December 1991), an air force lieutenant general, came in to return the shuttle fleet to flight. Morale was very low, but McCartney, an R&D engineer who had headed the US Air Force Space Command, restored the confidence of the workforce, and flights resumed.

Jay Honeycutt (January 1995–March 1997), the sixth KSC director, was the most successful in having KSC engineers and technicians participate in the design and manufacturing processes of both the space shuttle and payloads. Honeycutt finally got operations requirements back in the design centers and factories by having KSC personnel stationed at those locations to insist that operations needs be met. He also made a strategic placement by putting John "Tip" Talone in charge of the ISS effort at KSC. Talone was most successful in penetrating the design and manufacturing processes and in using the Apollo and space shuttle facilities and equipment so that elements of the ISS could be connected, checked out, and tested on the ground before being flown into orbit. Talone was also successful in refuting the ship-and-shoot mentality.

Other key players who were instrumental in successes at KSC were Rocco Petrone, Apollo launch director, and George Page, the first space shuttle launch director. Both were brilliant, driving managers. The chief design engineer, Don Buchanan, not only designed most of the ground support equipment and facilities but also solved many real-time operations problems with innovative thinking.

Few other books have been written about KSC. *Moonport: A History of Apollo Launch Facilities and Operations* by Charles D. Benson and William Barnaby Faherty, published by NASA in 1978 and available for free online (http://history.nasa.gov/SP-4204/contents.html), is very detailed and technical, but is limited to the Apollo program. *The Kennedy Space Center Story* (1972) by Gordon Harris and published by KSC is also limited and does not address the evolution of the center's management systems.

In preparing *A History of the Kennedy Space Center*, Lipartito and Butler conducted many interviews at KSC, other NASA centers, and NASA headquarters in Washington, DC, to flesh out their research of archives and personal papers of Debus and others. They bring alive and personalize the trials and frustrations, and the joy and excitement, of the launch operations crew at the center.

George English
Cocoa Beach
Florida

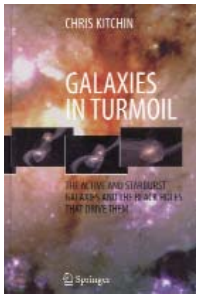
Galaxies in Turmoil

The Active and Starburst Galaxies and the Black Holes That Drive Them

Chris Kitchin
Springer, New York, 2007. $29.95 (298 pp.). ISBN 978-1-84628-670-4

Stars are the primary energy source of normal galaxies. Hundreds of billions of them account for most of the light that can be detected from a typical galaxy. In contrast, accretion of material onto a supermassive black hole at the galactic center is the energy source for active galaxies; the resulting radiation often outshines all the stars in the galaxy. The exceptional feeding monsters at the centers of active galaxies are called active galactic nuclei, or AGNs. Active galaxies, and the extremely luminous starburst galaxies, which exhibit unusually high rates of star formation, are the subject of *Galaxies in Turmoil: The Active and Starburst Galaxies and the Black Holes That Drive Them*, by Chris Kitchin.

Although they are distinct phenomena, AGNs and the intense star formation of starbursts together make a coherent subject for a topical book. Recently measured relationships between the mass of a central black hole and the total stellar mass in its host galaxy indicate that black hole accretion and star formation may be physically related and fundamental to galaxy evolution.



The text is written at a level appropriate for undergraduate students, and its intended audience also includes amateur astronomers. Kitchin, professor emeritus of astronomy at the University of Hertfordshire in the UK, is the author of several practical and technical observing guides. After lucidly explaining the physical processes of the tumultuous galaxies featured in his book, he devotes a chapter to observations that can be made with binoculars or a small telescope. His account of beaming in