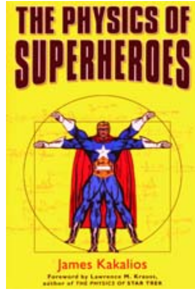

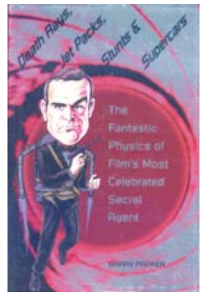

Physics of Superheroes. I was terribly disappointed.

The worst one is the book about Bond—James Bond—by Parker, a professor emeritus of physics at Idaho State University. The text drifts from merely annoying to sloppy. For example, he assumes every reader has a vivid memory of every moment of every Bond movie, and his ski-jump figure doesn't correspond to his text. The book also ranges from irrelevant to misleading to historically inaccurate to just plain wrong. Parker introduces a discussion on lasers by discussing Maxwell's equations and then never uses them; he implies that phase sensitivity is essential to three-dimensional perception; he wrongly asserts that Albert Einstein's $E = mc^2$ played a major role in the invention of the atomic bomb; and his description of nuclear weapons shows that he never read Richard Rhodes's excellent *The Making of the Atomic Bomb* (Simon & Schuster, 1986). Almost every page of Parker's book is seriously defective.

Kakalios's *The Physics of Superheroes* is better, but he is up against an impossible problem. Most science-fiction movies make a reasonable attempt at obeying physics, with a notable exception being Paramount Picture's *The Core*, but comic books make no attempt at all. Kakalios, a professor of physics at the University of Minnesota, Minneapolis, teaches a freshman seminar with the attractive name "Everything I Needed to Know About Physics I Learned from Comic Books." But his book shows that the seminar's catchy title is a gross exaggeration. Most of what superheroes do in comic books cannot be made compatible with physics. Kakalios hardly tries to reconcile the science fiction of comics with physics. Instead, he describes the powers of comic-book superheroes and uses those traits as an opportunity to launch into interesting physics. So, for example, a superhero who can walk through walls is used as an excuse to discuss quantum mechanical tunneling. But Kakalios's fundamental conclusion, which is correct, is that the hero's abilities are totally incompatible with quantum mechanics.

The author offers an interesting discussion of the historical development of some of the superheroes. For example, for the first year of Superman's comic-book existence, he couldn't fly; he could only "leap tall buildings in a single bound" as a consequence of his strength. Kakalios uses Superman's leaping ability to do some elementary physics calculations.

The beauty of physics is well hidden in both books. Parker writes down lots of equations, but he just pulls them out of the air, with no explanation or derivation or relationship to anything else. Kakalios offers virtually no equations, except for a one-dimensional version of the Schrödinger equation, apparently placed among the superhero images just to offer some mathematical dazzle. The contents of the books read like the sophomoric discussions by physics students who are making fun of comic books or Bond movies, and who are trying to show their wit and erudition. I can't figure out who would like the books. There are some nice moments, but they are too far apart to make them worth reading. I doubt that any reader of PHYSICS TODAY would enjoy either book, and I strongly advise against giving them as presents to either children or adult fans of comic books or James Bond—and I am a fan of both.

Krauss, author of the *Star Trek* book, wrote a foreword to Kakalios's book. He cleverly managed to write nearly two pages without endorsing it, other than calling it "far-reaching." He talked instead about the joy he has found in comic books. *The Physics of Superheroes* and *Death Rays, Jet Packs, Stunts and Supercars* are nowhere near the standard he has set. I give the books a thumbs-down—with both hands. If you want to give those who love reading about the science of science fiction a present, give them *The Physics of Star Trek*, still the best of its genre.

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Sculptured Thin Films: Nanoengineered Morphology and Optics

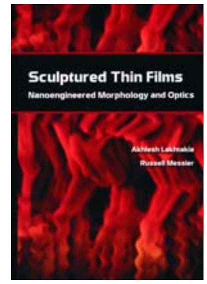
Akhlesh Lakhtakia
and Russell Messier
SPIE Press, Bellingham, WA, 2005. $75.00 (299 pp.).
ISBN 0-8194-5606-3

The title of *Sculptured Thin Films: Nanoengineered Morphology and Optics*, by Akhlesh Lakhtakia and

Russell Messier, is eye-catching. The book encompasses the concepts of emerging nanotechnologies for optical devices based on sculptured thin films (STFs). The field is a highly specialized and interdisciplinary one requiring expertise in materials-science and technology subjects—for example, well-identified deposition processes and parameters that both have reproducible structure–property correlation for STFs and devices. The field also requires an intimate knowledge of wave optics and electromagnetism, guidelines for practical device design and fabrication, and testing methods.

The task of providing such information is obviously daunting and has been accomplished so far only in carefully edited books with chapters contributed by experts in specific subfields. I was thus intrigued by the book from SPIE Press written by only two authors. Lakhtakia and Messier, who are both with the department of engineering sciences and mechanics at the Pennsylvania State University, have published extensively in their respective areas of expertise. In fact, in their preface they raise readers' expectations to a new height: Their goal is to present a clear understanding of the morphology and optical response characteristics of nanoengineered STFs and propose a recipe for potential optical devices.

However, I was disappointed, as their goal is not met. Their book rather resembles an extended research report on chiral STFs and their likely applications. After the overview in chapter 1, the authors address thin-film morphology in three brief chapters: History of Thin-Film Morphology (21 pages), Engineering of Thin-Film Morphology (33 pages), and Speculation on STF Morphology (7 pages). They cover STF deposition methods in another small chapter titled PVD Methods for STF (17 pages). These four chapters are descriptive but lack details that enable readers to correlate the morphology with the deposition parameters and process, and with the resultant properties of the film. Developing a physical vapor deposition (PVD) process with deposited-film structure and properties that are reproducible—even for single-element thin films—is highly complex. For a controlled deposition of optical-device-quality STFs, the process needs many bells and whistles that necessitate an understanding of the deposition environment, its chemistry and control mechanisms, and device characteristics. Except for citing a few general references on PVD, the authors do not discuss these critical issues.



In the next four chapters, which cover reflection and transmission of electromagnetic waves through columnar thin films (CTFs), sculptured nematic thin films (SNTFs), and chiral STFs, the authors use constitutive relations and modal representations to solve for the propagation parameters. The parameters are then related to the anisotropic dielectric constants and refractive indices of the films. The authors extensively use the Mathematica program, which is provided in a CD that comes with the book. But their higher-order polynomial curve fits have too many unsubstantiated variables, and so their discussion on morphology and optics in these chapters is speculative at best. Before one can confidently build intelligently nanoengineered CTFs and STFs with the potential to be used in devices, any prediction of properties should be authenticated by comparing with the actual measured data; and such a comparison is sorely lacking in this book.

In the last chapter the authors present mostly computed performances of chiral STFs for use in such applications as optical filters, optical sensors, optical emitters, and tuning and bandwidth control. Use of porosity in chiral STFs for such optical devices as sensors, emitters, or tuning and bandwidth control is far too speculative at this stage of development.

The scope of the book, per its title and preface, is far too broad and ambitious to handle. The authors suggest that it is targeted for graduate students in optics, practicing engineers in industry, or expert researchers. I would not, however, consider *Sculptured Thin Films* as a graduate text because of the shortcomings listed above. Practicing engineers in industry will find little use for the book as they look for workable recipes that are soundly tested against actual products.

Lakhtakia and Messier's book could be a good compendium and reference to students and researchers studying chiral-STF materials, properties, and potential applications. It includes an extensive bibliography—almost 450 references, with 122 being literature published by Lakhtakia and his colleagues—which could be useful for researchers in the field. But for understanding the controlled nanoengineering of optical-device-quality STFs and useful devices, readers will have to dig deep for other books and journal articles.

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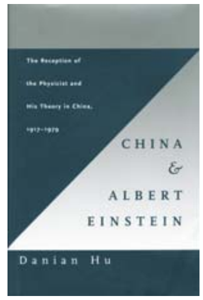
China and Albert Einstein: The Reception of the Physicist and His Theory in China 1917–1979

Danian Hu
Harvard U. Press, Cambridge, MA, 2005. $39.95 (257 pp.). ISBN 0-674-01538-X

Since the time of biochemist and historian Joseph Needham, many studies on science in East Asia have focused on the traditional science that preceded the introduction of Western science. But as scientific and technological contributions from East Asia become increasingly visible, more studies on modern science and technology will appear. Danian Hu's *China and Albert Einstein: The Reception of the Physicist and His Theory in China 1917–1979* was published while the world celebrated the centennial of relativity's birth and world leaders paid increasingly serious attention to China as a rising global leader. The book makes an important and timely addition to the historical studies of modern science in East Asia. Hu, an assistant professor of history at the City College of New York, demonstrates an impressive familiarity with relevant primary sources, published and unpublished, and illuminates a richness of his subject.



Readers might find the book overly descriptive; in particular, the first chapter, on the introduction of Western science to China, which begins with the Italian Jesuit priest Matteo Ricci arriving in the country during the Ming Dynasty, might seem too lengthy. Nevertheless, Hu attempts to make several thought-provoking arguments. In explaining China's quick and unanimous reception of relativity theory in the years after 1917, he first stresses Japan's influence through translations of writings on relativity theory in Japanese—most notably translations of Ishiwara Jun and through Chinese students who had studied physics in Japan. If Hu is correct, this revelation marks an important revision of the current thrust in Chinese history of science, which emphasizes Japan's negative roles.

Second, Hu argues that the absence of the research and educational traditions of classical physics set the stage for China's positive reception of relativity theory in the late 1910s through the 1930s. Yet, I find this argument less convincing than the first. Certainly, the absence of a tradition in classical physics almost logically entails the lack of opposition against relativity theory based on classical physical ideas. But the book does not historically demonstrate the specific roles that the absence allegedly played. The author could have achieved such a demonstration through a comparative study, which he does not.

I believe a fundamental problem of the book might be its formulation of its central goal: to explain China's quick reception of relativity theory. Hu seems to assume that China passively received the same relativity theory as the one in Europe or in Japan. Today's historians of science who are concerned with the dissemination of scientific ideas would find Hu's approach unacceptable. The author fails to ask what consequences language, culture, institutional differences, or Japan's influence had in the conceptualization and practices of relativity theory in China. This shortcoming is unfortunate because, considering the author's familiarity with the subject, he easily could have theorized how the practices of relativity theory differed in China from those in the West.

One argument that I find potentially fascinating is that the revolutionary atmosphere engendered by the May Fourth Movement in Beijing in 1919 helped the reception and dissemination of relativity theory, which Chinese intellectuals in the late 1910s and early 1920s deemed as revolutionary. Unfortunately, Hu does not fully develop that intriguing theme. His argument does not go much further than pointing out superficial connections between the Zeitgeist and perceptions of relativity theory, and his closer biographical investigations of physicists do not substantiate the link between the politico–cultural environment and relativity theory.

The most interesting and successful part of the book is the discussion of relativity theory during China's Cultural Revolution (1966–1976). The chapter might give a sense of déjà vu to readers familiar with the works of Loren Graham, Mark Walker, and others on science in Soviet Russia and Nazi Germany. Compared with those earlier studies on science and ideology, the picture that Hu's book presents appears to be somewhat simplistic, one in which political pressures distort truthful science while honest and heroic scientists fight against corrupt politicians. In addition, I cannot help but wonder whether China's nuclear program had any relevance in the vindication of relativity theory—a question Hu does not explicitly consider. Nonetheless, the author shows that the study of Chinese science during the Cultural Revolution might lead to an important reexamination of the relation among science, ideology, and politics throughout the world.

Overall, the analytical framework of Hu's book is problematic. Thus the author sometimes gives unsatisfactory analyses of rich and fascinating materials and fails to ask potentially important questions. His strength seems to lie in his studious accounts of complex stories. Despite its shortcomings, his meticulously documented study is an important step forward in understanding some aspects of the history of science in 20th-century China.