

that, when set theory was introduced into schools as part of the "new math," it was a bowdlerized version that omitted infinite sets; that is like leaving out the poetry when teaching Shakespeare.

Hoffman's description of an unfortunate controversy between Erdős and the great mathematician Atle Selberg is wrong; Schechter gets the story more or less right.

Hoffman's statement that Kurt Gödel tried but failed to prove the continuum hypothesis is misleading. In fact, Gödel succeeded in 1938 in showing that the continuum hypothesis is consistent with the axioms of set theory, and Paul Cohen showed in 1963 that the denial of the continuum hypothesis is consistent with the axioms.

Hoffman credits Ken Ribet with discovering that the Taniyama–Shimura conjecture implies Fermat's theorem; the first connection was, in fact, made by Gerhard Frey.

Hoffman correctly points out that today the distinction between pure and applied mathematics is more muddled than ever. Erdős was not interested in applications of mathematics; nevertheless, some of his most talented disciples have ended up in departments of computer science.

Hoffman goes on to quote John Tierney: "The remarkable paradox of mathematics . . . is that no matter how determinedly its practitioners ignore the world, they consistently produce the best tools for understanding it." So far so good. Unfortunately, Tierney then adds that "for no good reason, in 1854 a German mathematician, Bernhard Riemann, wonders what would happen if he discards one of the hallowed postulates of Euclid's plane geometry. His non-Euclidean geometry replaces Euclid's plane with a bizarre abstraction called curved space, and then, 60 years later, Einstein announces that this is the shape of the universe." This is at odds with what Riemann wrote. During his brief life, Riemann was deeply interested in science; a substantial number of his papers dealt with problems in physics. In his famous dissertation on the principles underlying geometry, he openly speculated on the physical meaning of curved space. So it would be more correct to say that in some general way he anticipated Einstein.

Back to Erdős: Because of his singular devotion to mathematics, his great contributions to it, the huge number of his collaborators, the goodness of his character, his disdain of worldly goods and honors and his eccentricity, Erdős has become a cult figure to those who knew and loved him. These books serve as a good introduction for those who did not have that privilege.

Fashionable Nonsense: Postmodern Intellectuals' Abuse of Science

Alan Sokal and Jean Bricmont
Picador (St. Martin's Press), New York, 1998. 300 pp. \$23.00 hc
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Many scholars who are not physicists or mathematicians appear to believe that the formal languages of contemporary physics and mathematics may fruitfully be employed in disciplines far from those for which they were originally developed. On the face of it, this is implausible. Those languages were constructed for such highly specialized purposes, and are characterized by such tight and intricate internal logical interconnections, that it would be a remarkable coincidence if, for example, the quantitative tools of the special theory of relativity had any relevance for understanding the structure of human societies or if the deep theorems of mathematical logic could be applied in psychoanalytic theory. Nevertheless, people have tried to make such connections.

Alan Sokal and Jean Bricmont share my prejudice that such efforts are futile. They are persuaded that little more has emerged from such attempts than a jumble of meaningless jargon and contradiction-ridden nonsense. To support their view, in *Fashionable Nonsense*, they offer many excerpts, ranging from a sentence to a few pages, from a dozen eminent authors such as Jacques Lacan, Julia Kristeva, Luce Irigaray and Jean Baudrillard. These passages do indeed sound like irredeemable rubbish to one who has learned to use in the original contexts the technical terms they employ. Not only is it impossible to extract from the excerpts any meaningful use of those terms, but it is clear that, if they are being used in anything like their conventional senses, then the authors of these excerpts have utterly failed to grasp their original meaning or purpose.

This raises questions: To what uses are the excerpted authors trying to put this apparently inappropriate language? To what extent has the broader setting from which the excerpts have been extracted loosened or shifted the conventional meaning of the technical terms? What apparently nontechnical terms in the apparently nonsensical passages have been elsewhere endowed by their authors with specialized meanings?

It is the great failing of this book

not to address such questions. If the passages are read as excerpts from technical treatises in mathematics or theoretical physics, then they are indeed manifest nonsense on an almost lunatic scale. That is how they are read by Sokal and Bricmont, who confidently announce that the cited authors are not only ludicrously ignorant of the technical concepts they invoke but that their real aim is only to impress their nonscientist readers with a technical expertise they manifestly do not possess.

These are serious charges that carry a scholarly and, indeed, a moral obligation to make a serious effort to come to terms with the offending texts. Sokal and Bricmont do not even try. Perhaps this is because the passages they cite, if read in the only way physicists and mathematicians know, are so transparently absurd that it seems a waste of effort to explore alternative readings. If Sokal and Bricmont's only aim were to persuade their scientific colleagues that some very silly-sounding things are being passed off as profound, then one would have to count their book a roaring success.

But that was not and ought not to have been their aim. If, indeed, many of the luminaries of critical studies are promulgating pure rubbish when they turn their attention to matters of science and mathematics, then those non-scientists who take seriously their discourse on less technical matters deserve to be warned of this. But warning, in this case, requires persuasion. There is nothing persuasive in a barrage of jocular declarations that the cited authors have no idea what this or that isolated chunk of what they have written is supposed to mean.

Potentially more convincing are Sokal and Bricmont's many attempts to explain how, if the technical terms in these passages are taken at face value, then they are being grotesquely misused. But the crucial question of why the terms should, in fact, be so taken, is never seriously considered. One cited author, for example, is taken to task for misunderstanding the symbol "+." "As we all learned in elementary school," Sokal and Bricmont tell their readers, "'+' denotes the addition of two numbers. We are at a loss to explain how Irigaray got the idea that it indicates the 'definition of a new term.'" Unorthodox this abuse of "+" may be, but does it take an enormous leap of the imagination to see $2 + 3$ as a definition of the new term 5? By being superficial in their more accessible jibes, Sokal and Bricmont badly undermine whatever confidence those readers who are technically unsophisticated might have had in their more

trenchant but more technically demanding criticisms.

Sadly, it will be easy for those who take seriously the nontechnical writings of the authors under attack here to read Sokal and Bricmont as every bit as naive, simple-minded, self-important and ridiculous as their victims will surely appear to most readers of PHYSICS TODAY. Instead of narrowing an unfortunate breach between two scholarly communities, this book will broaden it.

The final quarter of the book contains the text of Sokal's famous Trojan horse—the nonsensical paper he published as a hoax in *Social Text*—along with an appreciative exegesis of that parody, and a commentary by Sokal on the broader political implications of these disputes. There is also a 55-page critique of relativism in the philosophy and sociology of science, which it would require another review to comment on. (*Fashionable Nonsense* was originally published in France as *Impostures Intellectuelles* (Editions Odile Jacob, 1997).)

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Peace and War: Reminiscences of a Life on the Frontiers of Science

▶ Robert Serber
with Robert P. Crease
Columbia U. P., New York, 1998.
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0-231-10546-0

The subtitle to Robert Serber's *Peace and War* states accurately what this book is: reminiscences of a life on the frontiers of science. That life was anything but ordinary. Serber, who died in June 1997 at the age of 88, was a major theoretical physicist of this century in the US. His research and insights spurred progress at a number of scientific frontiers and left indelible imprints in such diverse areas as condensed matter, nuclear, accelerator and particle physics. His contributions to the American atomic bomb project, from its beginnings at Berkeley through the Los Alamos days and on to Tinian Island and Hiroshima and Nagasaki, following the Japanese surrender, were major and uniquely fascinating. And the reminiscences recounted in his book have a special charm. Serber, writing perceptively in a laconic and candid style, with the aid of Robert Crease (a science historian who contributes an interesting introduction to this book), leads the reader

on a chronological journey through his life of rich and varied experiences and his close associations with many of the major figures of modern physics.

The reader walks away at the end of this book with new insights into the human side of the scientific process; into the trials and tensions of life in the wartime pressure cooker (and behind some of the headlines and romanticized myths) that was Los Alamos; into the first impressions of life, death and survival at ground zero, where the two atomic bombs were dropped; and into the political strains and stresses—and casualties—that occurred as American physicists, returning to peacetime research after World War II became enmeshed in policy disputes.

Serber first met Robert Oppenheimer in 1934, when Serber was 25 and Oppie was 30, at the University of Michigan's famous summer school, and for the next 33 years, until Oppie's death in 1967, the two had a very close personal and professional relationship. This relationship forms one of the major threads running through the book. Out of it, Serber weaves a vivid picture of Oppie that reveals aspects of the personal life and human side of the great teacher and creator, during the 1930s, of the preeminent school of modern theoretical physics in the US. These insights add depth and shadings to the familiar image of this extraordinary physicist, who was the leader and soul of the atomic bomb project at Los Alamos but was publicly persecuted in the post-World War II era of the loyalty oath and the communist scare. Serber also candidly describes his own tribulations during this unfortunate period.

In a series of informative letters written to his wife, Charlotte, and reprinted in the book, Serber tells of his fascinating experiences in the Pacific, as a member of the team sent to Tinian Island for the final assembly of the atom bombs—both the uranium-235 gun assembly, known as "Little Boy," which was dropped over Hiroshima, and the plutonium-239 implosion bomb, known as "Fat Man," destined for Nagasaki. Flying was anything but routine in those times, and military snafus were frequent, including one that had Serber bumped from the second following plane on the bombing mission to Nagasaki, on which he was supposed to have served as photographer, with the result that no photos of that event were taken.

However, he and several colleagues did make it to ground zero at both Hiroshima and Nagasaki shortly after the end of hostilities, to observe and measure the bombs' devastation using their scientists' nuclear knowledge and

trained eyes. They arrived at Nagasaki before the first occupation forces and remained in Japan for more than a month, moving around and getting stuck in the usual assortment of mix-ups that characterized those days immediately following the war. His letters from Japan give graphic descriptions of the devastation as well as of some of his technical work, such as determining the altitude of the bomb's flash and the size of the fireball by measuring the shadow and penumbra in a room in the Hiroshima post office that faced the blast one mile from ground zero.

The concluding chapters of this short memoir describe Serber's readjustments to civilian life after World War II. He spent five years as a physics professor at the University of California, Berkeley, before the political schism in American physics on nuclear policy, and the decision to build the H-bomb, drove him east, to Brookhaven National Laboratory and Columbia University. He concludes his memoir with a description of the death of Oppie, his close relationship with Oppie's surviving family and his own retirement years and new family.

Throughout this book, the reader has a feeling of "you are there." The reader becomes a witness to a number of very exciting events in science, because Serber was there as a participant. He describes these events, including their human dimensions, simply and directly, without allowing himself to get in the way. Any physicist with an interest in the years when American physics came of age will enjoy and gain new insights from this charming reminiscence.

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Comets: Creators and Destroyers

▶ David H. Levy
Touchstone (Simon & Schuster),
New York, 1998. 256 pp.
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As an avid sky-watcher, both amateur (when out stargazing and Moon-watching) and professional (while studying comets, their dust, nuclei, and x rays for a living), I found David Levy's *Comets* fascinating and easy to read. Aimed at an audience of educated nonscientists and containing only a single equation (the simple, algebraic Drake equation describing the probability of extraterrestrial civilizations), the book is written from both historical and personal viewpoints.